ORGANIZING FOR NATIONAL SECURITY

SCIENCE, TECHNOLOGY, AND THE POLICY PROCESS

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BEFORE THE

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OF THE

COMMITTEE ON GOVERNMENT OPERATIONS UNITED STATES SENATE

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SCIENCE, TECHNOLOGY, AND THE POLICY PROCESS

MONDAY, APRIL 25, 1960

U.S. SENATE,
SUBCOMMITTEE ON NATIONAL POLICY MACHINERY,
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C.

The subcommittee met, pursuant to call, at 10 a.m., in room 3302, Senate Office Building, Senator Henry M. Jackson (chairman of the subcommittee) presiding.

Present: Senator Jackson.

Also present: Senators Robertson, Stennis, and Bush.

Staff members present: J. K. Mansfield, staff director; Dorothy Fosdick, Grenville Garside, and Howard E. Haugerud, professional staff members; and Edmund E. Pendleton, minority counsel.

Senator JACKSON. The subcommittee will come to order.

This morning, our subcommittee is starting 3 days of public hearings on the subject of how our Government can best gear science and technology into foreign and defense policymaking.

Science and technology are exercising a new and decisive influence on national power, prestige, and policy. The statesman, the soldier, and the scientist must work together as never before. The question now before the subcommittee is this: What is the right way to organize our Government to get the right scientific and technical programs at the right time?

The subcommittee's search for answers to this question represents one part of its broader task. That broader task is to determine whether our Government is now properly organized to meet successfully the challenge of the cold war. The fundamental problem is: How can a free society organize to outthink, outplan, and outperform totalitarianism—and achieve security in freedom?

At our first set of public hearings, held earlier this session, four eminent Americans—Mr. Robert A. Lovett, Mr. Robert C. Sprague, Dr. James Phinney Baxter, and Mr. Thomas J. Watson, Jr.—gave the subcommittee their estimate of the broad challenge confronting our Nation in the competition with world communism.

And now, this week, seven distinguished authorities on the relation of science and technology to national security planning have generously consented to give the subcommittee the benefit of their counsel on how our Government can do better in this area.

Between now and the adjournment of the Congress, the subcommittee will hold additional sets of hearings which will focus upon specific problem areas in existing government organization for national security, and which will aim at concrete improvements.

Among the key questions which will be explored by the subcommittee are these:

What can we do to help the statesman and the soldier work together for common goals? Here I have in mind the danger of the State and Defense Departments making plans with the left hand not knowing what the right hand is doing.

What can our Government do to develop a truly integrated national strategy for the long pull? Here I have in mind the question of how the National Security Council and its subordinate bodies can develop policies representing more than least-common-denominator compromises between the departments represented upon it.

How can the budgetary process be made a better management tool for clarifying, illuminating, and speeding the development of needed programs? Here I have in mind the widespread feeling that many important programs are stillborn or unnecessarily slowed because of the money agencies.

What can our Government do to recruit and retain outstanding senior officials for national security posts? Here I have in mind the chronic difficulties of the Defense Department and other agencies of finding qualified men—and, even more important, holding them long enough to master their jobs.

Our subcommittee has agreed with the President that testimony—

by present or former Government officials who have served on the National Security Council or its subordinate bodies regarding the National Security Council and its subordinate machinery will be taken first in executive session.

We have notified our witnesses accordingly.

In view of the fact that today's witness served on the Gaither Committee, I should also like to remind the members that President Eisenhower, in a letter to Senator Johnson of January 22, 1958, invoked the claim of "Executive privilege" in withholding the Gaither report from the Congress.

This fact, of course, does not prevent our witness from giving testimony concerning his personal views about national security problems and issues.

We are deeply privileged to have with us today Dr. James A. Perkins, vice president of the Carnegie Corporation, and vice president of the Carnegie Foundation for the Advancement of Teaching. In these posts, he has played an important role in promoting more effective research and teaching in the natural and social sciences.

Dr. Perkins speaks to us with an impressive background of experience in the relation of science and technology to national security. He was formerly Deputy Chairman and is now a consultant to the Research and Development Board of the Department of Defense. He is a trustee of the Institute for Defense Analyses and Chairman of the Study Group on Strategy and Foreign Policy of the Council on Foreign Relations.

As I have indicated, he also served as a member of the Gaither Committee, appointed by President Eisenhower in 1957 to survey national security problems.

Dr. Perkins, will you now proceed with your testimony?

STATEMENT BY DR. JAMES A. PERKINS, VICE PRESIDENT OF THE CARNEGIE CORPORATION

Dr. PERKINS. Thank you very much, Senator Jackson. I am honored to be here. I hope what I have to say will be of some use to this distinguished committee, dealing with one of the central issues of this century.

Let me proceed immediately to my prepared statement, and then, as I understand it, you will ask me a variety of questions.

Science and technology are the real revolutionaries of our time. Together they have helped to spawn the industrial revolution that is the hallmark of the modern state—a revolution still in progress. Together they have also helped to revolutionize military weapons and military policy. And both the industrial revolution and current military requirements have, in turn, placed increasing pressure on science and technology for even further invention and engineering capability.

The response has only served to produce still further requirements. We live today in the midst of this accelerating cycle and it is wise and proper that this committee give the most serious attention to its impact on our national security policies.

It should be stated at the outset that we are dealing with problems of enormous importance and complexity. There are no simple formulas for their solution. We are concerned here with nothing less than our organized response to the most central problems of our century.

Let us now turn to the specific features of this technological revolution and to the problems it has created for national security planning. The central fact is that scientific invention has largely conquered the three historical barriers to the application of force—namely, barriers of power, distance, and time.

Decades of quiet research in a dozen different countries slowly and methodically put together the puzzle of the atom. This knowledge has been engineered to produce a weapon no larger than a compact car that can obliterate a city in one blow. And even greater power is in immediate prospect. We are almost at the point perhaps where our conquest of power raises some real questions as to what to do with it. In any even, power is certainly no limiting factor in weaponry or strategy.

On another scientific front, scientific research of recent decades into the nature of heat, electricity, and aerodynamics has provided the scientific capability that has conquered the factors of time and distance through the jetplane and the intercontinental ballistic missile. And who knows what capabilities will develop out of the orbiting satellite combined with even more powerful fusion weapons?

But it is clear that these systems that can deliver almost infinite power anywhere in the world in a relatively few minutes have finally mastered the traditional barriers of power, time, and space.

We shall see in a minute how this series of conquests has profoundly altered the very nature of our national security programs and our established systems for devising these programs.

But before we deal with this issue, we must register several other conditionary factors that are prime determinates of the management and shaping of national security policy.

The conquests of power, distance, and time have not been purchased without a price. The complexity of weapons, their early obsolescence as new invention piles on new invention, the geometric increase in cost, the multiplication of systems as new technology opens doors to new capabilities—all these interlocking developments have required a major realinement of public expenditures. As research ideas grow to prototypes, to production orders, to established weapon systems—costs rapidly increase from thousands to billions of dollars. And, by definition, a program that will cost a billion dollars involves, I trust, a high-level policy decision. Thus, the process itself has forced research projections up to the level of high administrative concern.

The two derivative consequences of this cycle have been the injection of scientific considerations into our basic plans for national security. The other derivative has been the importance of the scientist and his output to the future growth and security of our country.

Let us summarize the points already made before we proceed further. Science and technology have, through research and engineering invention, produced weapons that can place almost unlimited destruction anywhere in the world within minutes of time. These weapons and the military requirements they have produced are responsible, on the one hand, for the profound instabilities in our relations with the U.S.S.R. and the rest of the world and, on the other hand, for profound instabilities in our domestic economic and political arrangements and allocations of resources.

Our response to both types of instabilities has been to return to our scientists for assistance that will produce stability. And, finally, we have found it necessary to plan our future by anticipating likely problems and making sure the connected pieces of the puzzle, both foreign and domestic, will fall in place at the right time and with the right effect.

And now to our most central question—has our planning for national security programs kept pace with the driving factors just described? Since Americans are never satisfied with the adequacy of their social arrangements, it will presumably not be out of order to suggest some directions which might lead to improvement.

I obviously cannot do more than suggest, in this prepared statement, at least, three or four specific areas of personal concern. I will leave any reference to the National Security Council until an executive session at the end of my testimony.

One. The global sweep of modern weapons makes it clear that foreign policy and military policy are inextricably linked. And yet, there are few indications, indeed, that this fact has influenced either the organization or the procedures of the Department of State. There is no high official in the Department who has these considerations as his specific responsibility. There is no counterpart to an Assistant Secretary of Defense for International Security Affairs.

There is not, as far as I know, any regular briefing of the top officials of the Department on the military component of our foreign policy. Junior officers do not attend military staff colleges in any significant numbers. If the military component is a decisive ingredient, there are few visible indications that the State Department has yet taken appropriate steps to develop the necessary internal expertise.

It is not an adequate reply to say that this marriage takes place at the National Security Council. Coordination at the top of two hierarchies will never produce real fusion of policy without adequate preparation for that fusion from the first steps in the process of policy formation.

Or, to put it another way, State policies that take little account of military considerations until they reach the top may suffer from unrealism. Clearly, the same organizational attention should be given to military considerations as is given to economic factors. The latter were introduced into the Department several decades ago and are now dignified with an Undersecretary for Economic Affairs.

My question is this: Does the military component deserve much less-significant treatment?

This is no academic point because there is abundant evidence that the absence of this expertise has in the past presented some acute practical difficulties. The doctrine of massive retaliation as an automatic reply to any Russian aggression seemed to ignore completely the existence and implications of a Russian strike capability. Early statements about our interest in southern Korea might have been differently phrased with a better understanding of the military importance of southern Korea to the defense of Formosa and Japan. The case for greater organizational attention to military considerations within the Department of State is, in my personal judgment, fairly conclusive—both in principle and based on actual experience.

Several recommendations on this front worth considering might be:

(1) Regular scheduled military briefings for all officers of the Department of State, from department chief on up. I know there are briefings, but I am arguing for a wider range, and with higher officers to be included.

(2) The appointment of a civilian officer for military affairs at the level of Assistant Secretary.

(3) At least two dozen middle-grade officers a year should be assigned to the National War College for their regular program of courses and instruction.

(4) Consideration might be given to developing the appropriate relations with a semiprivate research organization like RAND to secure appropriate assistance in the analysis of the military and strategic considerations involved in various foreign policies.

(5) As a general objective, the Department of State should have the same level of expertise in military affairs as does the Defense Department in political and international affairs. I trust during the questioning you will draw me out further on that particular point, Senator.

Now, my second big point is this: Just as modern weapons require military knowledge in the State Department, modern weapons and derived modern strategy have made largely obsolete existing organization in the Pentagon. If anything is clear, it is that modern warfare does not divide itself up into problems of land, sea, and air. Weapons have made the globe one large integrated battlefield and strategy, tactics, and the organization to support these must recognize this fact.

Functional tasks now divide along lines of strategic deterrence, limited warfare, continental military defense, civil defense, and military

assistance to allies in support of the above. The hard, unvarnished truth is that it has been impossible to assign tasks on a functional basis along existing service lines.

We have really known this but tradition, requirements of service morale, and plain inertia have kept us from making the necessary hard decisions to really unify the separate services and to create an organization in accordance with the tasks to be performed. Not willing to do so, we have tried to solve the problem by leaving the services intact and by loading additional paper authority on the Office of the Secretary of Defense. It has come as a surprise to no one that the rationalizing of land, sea, and air services with modern functions of strategic deterrence, limited war, and continental defense has not come off. We have plainly expected the impossible.

The present Secretary of Defense, Mr. Gates, is a happy reversion to the tradition of Forrestal, Marshall, and Lovett, which assumed that some prior experience would be useful.

This formula for resolving the problem of service divisions and functional tasks has also complicated the business of making the best use of our scientists and engineers. Vannevar Bush's dream of an integrated research and development program has at least until recently, fallen on the rocks of service rivalries and the operating weakness of the Office of the Secretary of Defense.

I am told there is currently a warm, close, and relaxed working relationship between the most distinguished gentleman and my good friend Herbert York, who is Assistant Secretary of Defense for Research and Engineering and his opposite numbers in the three service departments. However, the basic structure will require solid proof of miracles accomplished before I can believe that the ability and above-service orientation of even the present able research and development managers have surmounted them. Vivid memories of my own linger of research demonstrations of air defense systems that were supposed to be 99 percent foolproof, and strategic systems that dropped bombs with pinpoint accuracy.

The service missions they served had a profound influence, in my judgment, on the point of view and led us into untold expenditures on marginal systems.

A third concern has to do with the role of the scientist himself. We have seen how his services have become of decisive importance at all stages of the development of national security policy. My point is that he is in danger of being both underused or overused. He will be underused when he is placed in a Government laboratory and given detailed instructions and blinders and told to "solve the specific problem, please."

Experience has long since demonstrated the value of an arm's-length arrangement that makes it possible for a scientist to bring to bear his creative imagination on a widely and loosely defined problem. Scientific laboratories under military direction have frequently not prospered.

On the whole, a civilian management is preferable and, on the whole, the more creative the approach required, the more substantial the case for putting the scientist in a university environment on a contract arrangement.

But he can be overemployed, too. As the man with the answers to our deepest fears we are inclined to translate important special authority into authority in general. A specialist on atomic energy does not necessarily speak with equal authority on infrared devices or jet propulsion. Even less does he speak with authority on problems of strategic deterrence or on the probable outcome of the cold war.

We are in some danger, it seems to me, of repeating the mistakes of the thirties when the fears of depression produced an overvaluation of the general skills of the economist. The scientist like the economist has special skills of greatest importance.

But only when these scientists have, through experience or unique training, translated themselves into generalists should they be allowed to have a decisive vote in the public processes. It is no accident that two great and effective men, Killian and Glennan, did not come to their substantial administrative tasks directly from the laboratory.

Four, finally, this problem points up the long-range importance of an educational system that identifies, respects, and cultivates scientific talent. Real talent, creative talent, is our most precious commodity. Unless it is forthcoming, all other arrangements for its better use are still only arrangements. It follows, therefore, that the most decisive element for the long run in the whole complex of national security is the best possible educational system for the country. Impoverish this, and in my opinion we are doomed.

But three specific tasks devolve on our educational system if it is to give the broad support required for the complex management of our national security affairs.

First, as suggested, our program of scientific education must be of the best. This is not now the case. For details I refer to the statement by the President's Science Advisory Committee called "Education for the Age of Science," published last May. I had the privilege of being a member of the group that prepared that report.

Second, our future scientists must receive a thorough grounding in the social sciences and humanities for the simple reason that, as the revolutionaries of our era, they should be acquainted with the society they are helping to change. They must also be in a position to speak the language of the generalists and administrators who will become even more interested in their work.

And last, but far from least, we must make heroic efforts to raise the whole level of scientific understanding of the general citizenry. In a democracy scientists and engineers can probably go no further than the enlightened public will understand and permit. The two worlds so graphically described by C. P. Snow, that is, the world of the scientist and the nonscientist, must be united or at least adequately bridged if we are to survive as an effective, dynamic, and secure society.

Thank you very much, Senator.

Senator JACKSON. Dr. Perkins, may I first of all commend you for a most informative and constructive statement here this morning. I believe that your testimony will be most helpful in the work that we are trying to do in improving the national security policy process.

I should like to ask two questions, and then I will turn to my colleagues.

Dr. Perkins, you placed great stress on having top civilian officials who have an adequate comprehension of critical scientific and military facts, issues, and developments. Do you think that lack of such understanding has been a serious problem and have you any suggestions at this time for improvements?

Dr. PERKINS. Well, I think this has been a serious problem, Senator, because as our security policy requires a further and tighter integration of knowledge of diplomacy, domestic mobilization, science and military strategy, any one who comes to the council tables unfamiliar with the other parts of that puzzle is going to be a very hard person to integrate into those discussions.

I would say that the weakest link in the chain of discussion has been inadequate knowledge on the part of our civilians of both military and scientific matters. I think this has made the problem of coordination enormously difficult.

If you get a man who speaks Swahili and another who speaks French in the same room, you have a very hard time getting a common language out of them, and I think this is equally true of people who come from the civilian side of government, who have insufficient knowledge about scientific and military affairs.

What do you do about it? Well, there is a shortrun and there is a longrun answer to your question. The first thing, I think, is to make sure that people become thoroughly briefed on the ways of thinking and the positions of others who will participate in these coordinated councils. It is my impression that all too frequently officials have come to these discussions hardly even properly briefed about matters in their own department, because of pressure of work, let alone about matters that are likely to be brought up by people in other fields.

The longer range answer involves a basic change in our system of education. If you do not consider it a detour, I would like if I may to say something about the inadequacies of the preparation of our citizens for national security affairs.

Senator JACKSON. Would you get into what is being done in the private academic world to make up for the deficiencies that you have indicated?

Dr. PERKINS. I would be glad to. I think that we have seen a tremendous improvement in the last decade, Senator. At the time of the Korean war I had occasion to take a look at the courses being taught in our universities and at the books that were available to the private citizen.

We were in pitiful shape. There was hardly anything in the private domain that would give anyone a firsthand knowledge of some of the intricate problems involved in our security program. The result was that courses in government and economics were being taught as if defense expenditures were not now one-half our Federal budget and a large part of our preoccupation with foreign affairs.

There was no first-class center for studies in 1950 of our national security programs and defense policies. There was no private university center where military history and military programs were respectable topics outside of the ROTC, and even here the people

who were sent up for doing this kind of work were fairly narrowly trained. There was very little in the way of literature in our learned journals, scholarly meetings went on to talk about the Government as if a multi-billion dollar defense budget was not really an important matter for students of government, and foreign policy was taught as if the experience of World War II and Korea, that military factors were a decisive component—these courses were being taught as if this had never happened.

So, in 1950, a group with which I am proud to say I was associated, went to work to see what could be done to increase university competence in this area.

I think that I am able to report, Senator, that as of today there is a first-class group at Harvard under Henry Kissinger and Robert Bowie, who used to be in the State Department, and one at the School of Advanced International Studies under Paul Nitze. There is a center growing in Princeton under Klaus Knorr, and there is another one in Chicago, under Hans Morgenthau, and there are new ones at Ohio State, Wisconsin, California, and elsewhere, that are really trying to do the research necessary to illuminate these very tough problems. So, looking ahead for the next decade, we are likely to have people to whom these matters are not so strange as is the case today.

But I think that the private sector at long last—and by that I mean the world of the universities and of the press and of our magazines and of our professional associations—are at long last beginning to grapple with these problems.

Senator JACKSON. That is a very fine explanation. I assume the real problem is that the civilian who has the responsibility in this broad area of national security, must understand all the components that are involved in national security.

Dr. PERKINS. Yes, sir.

Senator JACKSON. Whereas, this Nation in the past has been confronted with military wars, the challenge today cuts across every facet of human activity, is this not correct?

Dr. PERKINS. This is true, and you have raised a point that I think needs some emphasis, Senator. Our Government and our society, thank God, is a civilian-managed society. But civilian management will not be maintained just by law, but will have to be demonstrated by effective practice.

So, the civilian managers, be they members of our legislative bodies or of the executive branch cannot afford to be ignorant of any section of the public process that is decisive for the future management and direction of our country.

In my judgment, this whole area of security policy and military policy has been woefully neglected and the jury is still out as to whether or not the civilian managers will learn fast enough some of the complexities involved in order to maintain their right to be managers.

Senator JACKSON. Dr. Perkins, our next set of hearings will relate to the need for the best experienced and trained people in government. I am glad that you have called to the committee's attention the importance of well-trained civilians to administer not only the important affairs within the Department of State, but I believe you have very

effectively pointed out the importance of highly competent Secretaries in the Department of Defense in order that we can have in effect true civilian control of the military, for example.

You cannot get that kind of control if the civilians are there for a short time and really have not had an opportunity to understand intimately and thoroughly the role that they must play in that particular area of national security.

Dr. PERKINS. I couldn't agree with you more. I think that civilian control which we all thoroughly believe in is of decisive importance. But it is not something that you can legislate. You can give the person the right to exercise control, but that control may be a paper control if the person who is to exercise that control is not fully conversant with the areas in which he is to do business.

I would say that civilian control in the Pentagon is directly proportionate to the amount of know-how on the part of the civilian secretaries. If a person has all of the paper authority on earth, he won't dare to exercise it unless he is confident about the effects of his actions.

Senator JACKSON. I have made the comment that while people worry about a military general staff taking over, I think the greater menace is a civilian general staff that has great power but is not in a position to exercise it as our forefathers provided for in the Constitution.

This is one of our great problems, and I think that it is a great mistake when people assume that they can learn their job in a few months and then proceed to make great strategic decisions.

Dr. PERKINS. I think it is important to remember, and I do not mean to detour you off on another question, but what you say prompts so many ideas that are in my head. The civilian managers in the Pentagon that have really turned out to be the most effective are those that have had some experience in the Pentagon and preferably even some experience in the State Department. My most distinguished friend who has been before this committee some weeks ago, Robert Lovett, is a perfect case in point of a man whose effectiveness was in no small measure due to the fact that he had had very high positions in both the Defense and State Departments. This is also true of Tom Finletter, who was both in the State Department and in the Defense Department.

Marshall operated on both sides of the river. I think they recognized the fact that the Secretary of Defense has to work very closely to the Secretary of State if this system is going to work. And to have had experience in both Departments is of enormous value to see to it that that integration takes place.

Senator JACKSON. Senator Robertson?

Senator ROBERTSON. I was just interested in your statement that we could either underuse or overuse our scientists. Which do you think we have been doing?

Dr. PERKINS. Both.

Senator ROBERTSON. What is your proposed remedy?

Dr. PERKINS. Well, there is no easy remedy. I would say that on the underuse of scientists, I would make very sure that directions and instructions given to scientific personnel are not too tightly drawn.

The other side is important also. When you are dealing with scientists, if you want their creative response, you give them a fairly broad problem and then ask them to use their genius to seek a satisfactory answer.

On the overuse, I would just make certain that they do not carry, because of their obvious eminence and authority as scientists, too much weight in matters where scientific know-how is not really the decisive matter.

When you translate a scientific capability into public policy, you must be very sure that the scientist realizes he is operating there as a specialist and not a generalist. I would make sure that the President or anyone else who has a scientific adviser, makes sure that he knows both the limits and the advantages of the advice he is getting. I think this involves a great deal of knowledge about how to use this marvelous scientific expertise.

Senator ROBERTSON. Have you ever known any scientists, a Ph. D. scientist, and that would be the top echelon, I suppose, who appeared to have any difficulty in translating theory into practical works?

Dr. PERKINS. Well, I could think of a good many. As a matter of fact, it would be easier for me to think of the few who had no such difficulty, Senator. I would think that the two men that I mentioned, although they are not certainly known as pure scientists, Keith Glennan, who runs the space agency, and Dr. Killian, who used to be the head of the President's Scientific Advisory Committee, were successful largely because they had had a great deal of administrative experience other than that of working in a laboratory, or of teaching classes. They are those very rare fellows called scientific administrators.

I think that there are relatively few of them, and we need a lot more. James Fisk, who is the president of Bell Laboratory, who I think is appearing before this committee, is another case in point. And there are, of course, others.

Senator ROBERTSON. Now, Doctor, you said that we were not making the proper utilization of our scientific knowledge. You said that research did not seem to prosper under military control, and that is the reason I asked you the question.

The major issue, at least from the standpoint of survival is a military potential that will stay the hand of an aggressor. I infer that you would rather turn the scientists free to study the things they prefer to study, rather than to leave them under the control of the military, when the military might say, "We are not as much concerned about sending a man to the moon as we are to send a 1,000-pound payload to the Soviet Union, if they should start shooting."

What is your answer to that?

Dr. PERKINS. If we are going to gear scientists into working on our military requirements, they must, of course, work on military problems. I would merely state those problems in a way, Senator, that would give the scientist a chance to exercise his real creative talent.

Senator ROBERTSON. Then they should be given military problems.

Dr. PERKINS. Indeed they should.

Senator ROBERTSON. All right. Now, you criticized our military setup and recommended unification. What specific plan did you have in mind?

Dr. PERKINS. I have two or three things to suggest that would lead toward unification. Let me suggest one or two. These are directions in which I think reform might take place.

I am not naive enough to believe, Senator, that a plan could be drawn up and we could overnight amalgamate the services and everybody would come out in the same uniform. I don't think that our country works that way, and as a matter of fact, I think it probably would be disastrous. But I think two or three things would help in this unification. I think the chief officers of unification, the Secretary of Defense and the Chairman of the Joint Chiefs of Staff should not be put in those positions unless they are able to manage a unified program, and I said earlier that putting men into the post of Secretary of Defense who have to learn on the job is one of the weakest ways to direct this program into a unified way.

While he is learning it is obvious that the services have to go their own way until he tells them to do something different. So my first recommendation would be that we never put anybody in the post of Secretary of Defense who has not had a minimum of a year, and I would prefer 2 years, in the Pentagon and preferably if it could be done, and this may be asking too much, that this person have had some experience in the State Department or some other department of the Government.

Senator ROBERTSON. I agree with you there.

Dr. PERKINS. I think this would be my first suggestion.

Senator ROBERTSON. I am talking about unifying the Army, Navy, and the Air Force.

Dr. PERKINS. I am, too.

Senator ROBERTSON. But you were talking about the experience for the Secretary of Defense.

Dr. PERKINS. The Secretary of Defense is the chief instrument through which we are going to provide the unification. If you don't have it there, you won't get it.

Senator ROBERTSON. You go ahead and explain it.

Dr. PERKINS. So that would be my first.

Secondly, the Chairman of the Joint Chiefs of Staff must be given adequate authority.

It is my judgment that only when we have centralized authority and responsibility in the same office will it be possible to control the military at all. The easiest way to dodge the problem of civilian direction and of unified control is to not make clear who it is that is keeping store.

Now, third, a very radical idea which I have——

Senator ROBERTSON. Before you leave that, you have not recommended any powers for the Secretary of Defense that he does not already have, have you?

Dr. PERKINS. I was saying earlier that the Secretary of Defense may have all of the legal or paper powers that you can give him. If he does not have the experience and the knowledge to exercise them, they will not be used.

It is my general observation that the paper powers we have assigned to the Office of the Secretary of Defense have exceeded the competence of the Secretary to exercise them. That is largely because they have had to learn their job when they arrived in the office. So I don't think

it is a problem of assigning additional paper authority. I think it is a matter of seeing to it that men are there who are able to exercise the authority they have.

I have a third point. Someone has suggested that consideration might be given to seeing to it that general officers above a certain rank no longer receive their ratings or no longer even necessarily receive their direct assignments from the military officer of their particular department, but they might become officers who would operate more directly under the Chairman of the Joint Chiefs of Staff and the Secretary of Defense. I can see all kinds of nightmares in moving in this direction, but this might be one way of seeing to it that at least the top list of officers operate under some kind of unified management.

But if somehow or other, these officers could realize that there is a military establishment that goes over and beyond the service in which they are trained, I think it might be helpful, too. I don't think that there are, as I said earlier, any simple formulas for the solution of this problem. But I would like to see three or four improvements being activtly, directly, consciously and responsibly pushed.

Senator ROBERTSON. Don't you think that even if we cut out the Naval Academy beating the Army, and cut out the Army beating the Navy and you still have a Chief of Staff or have a member of the Joint Chiefs from the Navy and from the Army, you are still going to have service rivalry?

Dr. PERKINS. I don't hope in my lifetime to see—

Senator ROBERTSON. Do you think we can have the present setup of a staff composed of the heads of the four branches, including the Marine Corps? Do you want to keep that or do you want to abolish that?

Dr. PERKINS. I think that at the moment, I do not have any idea that we should radically reform the individual services we have. I do not believe in revolutionary change, Senator, because I don't think that it works. You just lose too much momentum.

I do think that there are three or four points in this system where I would be more comfortable if I saw more progress than is now the case. I would like to see more unifying capability rather than paper power in the Office of the Secretary of Defense. I would like to see more power if that is necessary placed in the chairman of the Joint Chiefs.

I would like to see explored the question as to whether or not our top-ranking officers could be given a central rather than a service orientation. I would like to see explored ways in which this independence and separateness that is inculcated at the very outset of a military training could be minimized.

In all of these directions, I think, progress lies. It is not in any one big revolutionary change, and so I would not change the four services tomorrow or next year or the next couple of years. But I would like to see the system slowly and gradually modified. This, I understand, is the way in which we progress in this country.

Senator ROBERTSON. I have just one other question, and I apologize to my colleagues for taking up so much of the time.

Dr PERKINS. They would have asked them if you hadn't, so it is just as well.

Senator ROBERTSON. You don't have to answer this unless you feel it is appropriate. But in previous hearings the witnesses have been

asked to comment on whether or not we can get an adequate defense within the framework of the President's defense budget. Would you care to comment on it?

Dr. PERKINS. Senator, anyone with an academic background finds it difficult not to comment on any question. So I will comment and gladly, but as long as you understand what you are getting.

I have not had a chance to review the military budget for 3 years, so anything I say could be said to be out of date because of changes in the picture that have taken place in the last 3 years.

But I would say in principle, Senator, that I find it hard to believe on the basis of what I knew 3 years ago, that a spreading and evolving technology that has involved more and more complicated weapons can be fitted into a system that says in advance, no matter what it is you request, make sure it only comes to X billions of dollars.

It strikes me that this is like pumping air into the tire but not asking the tire to expand. It is my view, sir, that we have in the past 4 or 5 years probably passed up capabilities in the field of air defense, and in the field of limited war capability in order to make certain that new deterrent weapons systems—the B–52 and B–58 and B–70, ICBMs, and the Dynasoar and others—can be accommodated into our budget.

So I would say that somebody would have to prove to me that we have not given up important capabilities in the field of air defense and limited war and maybe even in our deterrent program as the price of getting all of our strategic requirements within a fairly stable military budget.

I don't know whether that is responsive to your question or not.

Senator ROBERTSON. Oh, yes; it is. You have not changed the views you had, when you served on the Gaither committee; have you?

Dr. PERKINS. No, sir.

Senator ROBERTSON. Thank you very much.

Senator BUSH. Going back just a moment to Senator Robertson's question, Dr. Perkins——

Dr. PERKINS. Do all of the Senators ask such tough questions?

Senator BUSH. This one can be answered very briefly, I would think.

Senator JACKSON. That is usually the way the question starts.

Dr. PERKINS. I am braced for this one now.

Senator BUSH. You have been doing all right. I can say that for you, sir.

Dr. PERKINS. Thank you.

Senator BUSH. In some of the recommendations along the lines of unification a few years ago when we passed the unification bill, so-called, which you say has not unified very much yet, except on paper, the question of the common uniform for the services came up.

I wondered whether you would care to comment on that this morning? Do you think that would help us in our general drive toward unification?

Dr. PERKINS. It is a symbol. It is a symbol of separateness, Senator. It has in the past performed a very important function of maintaining service morale and of distinguishing real military functions.

I must confess I would be very interested in seeing a positive exploration of what would happen if we could put our very top officers in the same uniform. This would follow along the suggestion I made earlier, that if an officer achieved the rank, I would start with two-star generals—all two-star generals should wear the same uniform to indicate that they are now in a general service rather than a special one, and if it works there, try it to the next rank below, and I would work my way down.

It may be that in trying it, it won't work. But I would like to see it explored.

Senator BUSH. You think the way to explore it is to begin at the top, and not generalize it right off the bat?

Dr. PERKINS. Yes. I would start at the top and work down. If it works there, you can go further. Here is where interservice cooperation can really take place. There is far more contact between officers at the two-star rank, than at the rank of first lieutenant.

Therefore, I would start at the level where it would be most natural to start it. But you have me out on a point that I would make sure you understood I had not thought out in detail and I would just once again say that there must be many things that must be explored, that can slowly but surely move us in the right direction, and this is one.

Senator BUSH. This is one of the recommendations which recurs from year to year.

Dr. PERKINS. And I think that I would like to see it tried.

Senator BUSH. In the Hoover Commission reports, and also in the recent report by the staff of the Joint Economic Committee of the Congress, there were comments about the failure to integrate purchasing, especially in common-use items. Are you familiar with either one of those reports, on that subject?

Dr. PERKINS. Well, I used to be.

Senator BUSH. I think the Commission report shows that through the proper integration of purchasing, especially in the field of common-use items, a savings of close to $4 billion a year could be realized, which is no small matter, in relation to the total defense budget, but you are not particularly familiar with that area.

Dr. PERKINS. I am not particularly familiar with it, but I at one time had a number of conversations with Secretary McNeil, who used to be the Assistant Secretary of Defense in this area.

Senator BUSH. And a very able man.

Dr. PERKINS. I would like, if I may, Senator, to just pay my respects to a very distinguished man, Secretary McNeil, who is precisely the kind of person I was describing that could exercise real control because he had real knowledge. McNeil knew as much about what was going on in the three departments as did the people in the departments themselves. I think that the stability of the office of Secretary of Defense over a period of almost a decade is in very large measure to be attributed to the stabilizing expert influence of Mr. McNeil, and I am happy to be able to say this in public.

Senator BUSH. That is a wonderful tribute, and I am glad to hear that. I hold the very highest opinion of him, and I am sure we all do, but you have put that in splendid language and I commend you for that. I congratulate you upon it. I agree with you very, very much

indeed. I thought that it was a very sad day for the Department and for our country when he had to pull out of there.

Dr. PERKINS. I agree.

Senator BUSH. In your prepared statement, Dr. Perkins, you make three recommendations in the field of education. First you refer to the program of scientific education, that it must be, of the best and you refer to the President's Science Advisory Committee report. Does that report make recommendations for anything that the Federal Government or legislative branch should be doing in this field that we are not doing?

Dr. PERKINS. It did not try to frame legislation, so I think the answer to your question is, in general, "No." But I would think that anyone interested in scientific education should read that report. Dr. Dubridge, the chief of the University of California Institute of Technology, was the head of the group that wrote that report, and he deserves whatever credit comes from having worked on that document.

Senator BUSH. Of course, we are naturally interested here in what our responsibilities are in that field, and that leads me to the second question: You say our future scientists must receive a thorough grounding in the social sciences and humanities and so forth. Do you care to comment on that so far as the legislative responsibilities are concerned?

Dr. PERKINS. Now I will have to make a general comment, since you have raised it in both cases, about the responsibilities of the Federal Government. This is a whole new hearing in itself. We are just now, as a country, debating the proper role of the Federal Government in the field of education. I would think in this particular area that we are discussing now, the Federal Government's contribution has been primarily in the field of scientific research and only secondarily in instruction although the National Science Foundation has made major contributions to some exciting developments in secondary school scientific instruction.

I think the Government can be proud of its efforts in this field. With relatively few exceptions I would say that the funds that have gone to our universities have been very skillfully managed by the people in the Federal Government and have been put to very good use.

The National Science Foundation, which some of you here may have had a hand in creating, has had an almost decisive influence on seeing to it that badly neglected areas of science are properly funded with Federal money. The Science Foundation is almost a measure of the way in which public money can be spent wisely and with objectivity by skilled managers.

There is another point, however, which I think might well be of concern to people interested in what the Federal Government can do, and that is that research is only one part of the business of mobilizing our scientific expertise. We have also to concern ourselves with the whole program of instruction and we are not going to get research in this country done by capable people if we do not take a very hard look at the way in which science is taught all of the way down to the seventh and eighth grades in our schools.

The Carnegie Corporation made a little study of this, and discovered that really the turning point in the careers of future scientists in this

country takes place at the seventh and eighth grades when they first hit mathematics.

Senator JACKSON. Right at that point, if I might break in, a specific illustration was the five famous scientists from Budapest, Hungary, Dr. Szilard, Dr. John von Neumann, Dr. von Karmen, Dr. Teller, and Dr. Wigner, who will testify—all five of these men made some of the greatest scientific contributions that have been made in the last 15 years, and all won a prize in mathematics in high school in Budapest. It started them on their way to brilliant scientific careers.

Dr. PERKINS. We are dealing with the central switchboard here. It is at these grades, Senator, that a good many students decide their careers. They don't know that they are doing so, but in effect they are. That is because their first exposure to mathematics largely comes in our system around the eighth grade, just before going into high school.

Now, if that exposure has been interesting and exciting and well managed, they then go on and they are not frightened by taking science and mathematics courses in high school. If they are frightened or discouraged, they pass it up because in most of our high schools, and not all of them, mathematics will not be a required subject. So why is it that so much of our potential scientific talent is lost at this level? It is lost because so many who teach mathematics in the seventh and eighth grades have not been adequately trained in this field themselves.

If this is improved, we will not be losing our top talent, and they will go into the high school areas of mathematics and science with more vigor and interest, and our talent supply may be doubled and trebled. We may find that we have lost the Von Neumanns in the seventh grade without ever knowing it.

Senator BUSH. I could not agree with you more. I may observe, and probably other Senators have, that I give civil-service examinations to applicants for the Military Academies, and they get marked, and the deficiency in mathematics is appalling.

That is revealed in these applications and these men are going to Academies where a knowledge of basic mathematics and ability to absorb more of it is essential.

Dr. PERKINS. That is right.

Senator BUSH. It really frightened me to see how badly our youth is doing in that connection, and I do not believe the State of Connecticut is behind any in its educational system and I think offers as good a chance as any.

Now, finally, I want to ask one more question, and this is for my good friend, Senator Stennis. Your final statement is "And last, but far from least, we must make heroic efforts to raise the whole level of scientific understanding of the general citizenry."

That is a nice undertaking for someone. I wonder how you think we could be helpful in that.

Dr. PERKINS. Well, of course you start with what we have just been talking about.

Senator BUSH. Yes; I understand that.

Dr. PERKINS. You cannot allow just scientists any more to take mathematics and science courses. A high school program that does

not have a required exposure to mathematics, physics, chemistry, and biology is going to be turning out thousands of young people to whom this new world is unknown. So I would start by saying that we have to see to it, and make it a requirement, that everyone capable of understanding the subject matter, have a basic exposure to mathematics and one of the hard sciences, that is physics or chemistry, and to the rudiments of biology.

Without this, there is no base on which later on they can come to understand our new world. Then I think those who have gone through college without this minimal exposure should be encouraged to take courses that would fill the deficiency. I am afraid relatively less attention is given to upgrading in this area than is perhaps in more easily understood skills.

So the second thing I would recommend would be that those concerned with adult education see to it that offerings in this area are made by able people, by people capable of teaching and instructing those who only have a general knowledge.

Senator JACKSON. What you said about the teachers in mathematics and the lack of quality there suggests that they, too, find the subject uninteresting, and the field doesn't attract the same quality of teacher that goes into the social sciences, and the languages, and so forth. I wonder what we can do about that, because of the importance of the field of mathematics. How can we attract better teachers into that area? Do you think we should put premiums on it?

Dr. PERKINS. This has been debated in educational circles, but I think the business of paying salary premiums to attract people would wreck any school system. I have seen ideas for paying mathematics teachers $1,000 a year more than the rest of the teachers. I am afraid they would be hunted men and women and their lives would be made miserable. I think the general level of teacher compensation must be increased.

But one thing would do it as much as anything else. If the teaching of science in both primary and high school, was considered an important business by the chief scientists of this country, you would change the whole view of the attractiveness of these positions. The collegiate teacher, and not only the natural scientist, has to a great extent felt that instruction at the secondary level was believed to be of a lesser order of importance than instruction at the collegiate level. The result is that people who had any scientific capability have gravitated away from teaching science at the secondary level, and have left it to people who have not had adequate preparation.

Now, there are signs that this is changing, too. For example, there is a very important program going on at MIT, for the upgrading of the teaching of physics in our primary and secondary schools, led by Dr. Zacharias, a very able and energetic scientist. Through film, TV programs, and upgrading of books, a group of collegiate teachers of science have begun to concern themselves with the way in which the teaching of physics can be improved at the secondary school level. You have no idea, Senator, what it has meant to the teachers of sciences in secondary schools to discover that half a dozen of the leading scientists of the United States really think that what they are doing is important.

Senator BUSH. That is recognition, you mean.

Dr. PERKINS. Yes.

Senator BUSH. Thank you.

Senator STENNIS. Mr. Chairman, I especially want to thank you for the invitation to be around here this morning and hear this very fine statement and additionally Dr. Perkins' answers to these questions. I understand that you want to go into executive session.

Senator JACKSON. We have time, so you go right ahead, Senator Stennis. Senator Stenis is on the Armed Services Committee and the Appropriations Subcommittee handling all funds for the Department of Defense, and he has been most helpful to us during this study.

Dr. PERKINS. I have had personal advice on this score, Senator.

Senator STENNIS. Well, I certainly am impressed with your very fine statement.

I am going to be brief, Mr. Chairman, because I know you have this executive session coming up. But I think that it will be of interest to you as well as to the committee, Dr. Perkins, to know that what you said with reference to teaching mathematics in the seventh and eighth grade was mentioned just yesterday to me by a very eminent jurist, a Federal judge. He applied the same rule with reference to the need of the emphasis on mathematics and other hard courses at the same level for lawyers. He said that he detected the lack of clarity and the reasoning and the lack of ability to express themselves with clearness and succinctness among lawyers today. He thought undoubtedly those same men, if they had the proper emphasis in the hard courses in the seventh and eighth grades and at the high school level would be far more successful in their chosen profession.

He has a different profession in mind than you do. But you come out with the same answer exactly, and he has the same observation.

May I say, too, as one who has struggled along in an average way for several years as a member of the Armed Services Committee, and I say this without criticism at all of the personnel of the military services, that I think that your remarks are so very timely and so correct, too, with reference to the problem here regarding so-called unification or getting the most out of the dollar and the men, too, and the talent. I no longer blame the members of the military for their position and their attitude about what I call revising unification.

I spent Saturday at the University of Virginia where they were having a moot court. The alumni were there. I just thought that those young men were going out as young lawyers, what if they were told that all of the promotions at the bar are going to come from a group of lawyers that are up the line, which is going to pass on them and grade them, and that their allegiance is to that group rather than getting into the business part of the world. That is what we do to our military men, after all. We tell the young graduate in the Air Force, "Your promotion is going to come in the Air Force and it is up to you to back the Air Force and that is your career and that is your problem."

We say, "You are going up the ladder only through the word of men that are above you, the selection board." I think within their system they do a good job, but it is the system.

Then in the Army, the young Army men are told the same thing. So naturally they pull in that direction. They keep that trace tight all of the time and they would not want to disturb the system that

they are serving and it in turn serves them on their merits. So I think that you are correct about those senior officers. But I think that we are going to have to start to change the system with the junior officers, too. As long as we train them to serve those services in that way, and the promotions come solely that way, I think we are going to be victims of it and they will be victims of having the more limited viewpoint, that their talents go way beyond.

Now, as you say, it is certainly not a revolutionary matter of changing that. It is an evolutionary process.

Senator JACKSON. Might I just interrupt to say what impressed me at least was the realistic approach that Dr. Perkins made to the questions put to him on this ever-recurring problem of reorganization of the Department of Defense. We hear about so many grand plans that are going to change everything in one document.

What appealed to me this morning was the fact that he has made an approach based on human behavior and human reaction and human attitudes. I think it comes closer to achievement than some of these far-reaching proposals that promise the solution to everything.

Senator STENNIS. I agree heartily, I thought the key question on that problem was Senator Robertson's when he asked you what is your plan. You said you did not have a plan. You said it was an evolutionary process. I find a great many of the military personnel themselves seem to realize this, and want more done about it. I want to give one illustration, Senator Jackson. You so clearly say here, "Functional tasks now divide along lines of strategic deterrence, limited warfare, continental military defense, civil defense, and military assistance to allies in support of the above. The hard, unvarnished truth is that it has been impossible to assign tasks on a functional basis along existing service lines."

Last week we considered the air defense of the Nation, and we had General Kuter here who is in charge, a 4-star general as you may know. You might be amazed to know that the money for that vast program has to be supplied partly by the Air Force, and partly by the Navy and partly by the Army. In the course of some changes those services, it seemed, just made some shifts in their plans and withdrew some of their support to a vital part of his program. The shifts were actually made, and he advised against it, but he just woke up one morning and the support was gone. It was an amazing thing to me. We are spending many billions of dollars, and I am not directing criticism to any one, on a system that would operate in that way.

Dr. PERKINS. I just wanted to say, that I would not be surprised, Senator, because this is the way in which the system almost has to work. It is not only in air defense. If you take our strategic deterrent program today, I am sure that one of the great problems of coordination that is coming up is going to be the coordination of our airplanes, operating from our SAC bases, with the ICBM's, and with the Polaris missiles operating out of submarines scattered over the ocean. The problem of coordination of this is immense. Even to think about how you are going to do it is pretty tough. But when you have these capabilities divided between the Air Force and the Navy, you have introduced real hazards, because the coordination cannot take place between these two services until you get too far up.

The same thing of course is true in air defense, just as you say. The officer in charge of the air defense system who operates out of Colorado Springs has always faced the possibility since it was started, that a component, Army or Navy or Air may be reassigned in order to meet a service requirement. There is nothing he can do about it except to appeal to the Secretary of Defense.

Most people in this position, I would say, will walk into a service decision to reallocate men and materials with greater care unless they have been in the business a good while.

Senator STENNIS. Well, you are so correct. May I take just a moment to join you in your complimentary remarks to the Assistant Secretary McNeil, whose name came to my mind while you were describing the type of men that we need, even before his name was mentioned.

I was tremendously impressed with the services that he so unselfishly rendered. He had a very becoming modesty, too, and I am glad to see that he is recognized in your circles, and I would like to see it everywhere.

Mr. Chairman, I thank you again, and Dr. Perkins, too.

If I may make one further point here, I think that General Taylor's book, and I am sure it has come to your attention, with reference to the assignment of a task rather than the service idea is important. I think that he made a very fine contribution.

Dr. PERKINS. That is Gen. Maxwell Taylor; yes.

Senator STENNIS. I think he has one of the finest minds of our time, and he has made a contribution in that book.

Dr. PERKINS. I think the books that have come out of some of our distinguished military officers commenting on their own personal background and experience are invaluable additions to our knowledge, and I would put General Taylor's book high on that list.

Senator STENNIS. I thank you, Mr. Chairman. I have concluded.

Senator JACKSON. The questions were very helpful, Senator Stennis, and I particularly appreciate your bringing out the fact that we had a little experience in this problem of Defense Department organization in connection with the air defense situation. I think it is also an example, Dr. Perkins, of what happens when each service has this budgetary ceiling. They have to decide then on how they want to live under that ceiling, even though it has a very substantial effect in an area where they do not as a service have a great concern. This is exactly what happened in connection with the budget for Norad. The committee was advised last year after a so-called master air defense plan was worked out that this was the absolute minimum effort that we must make. In the meantime, for a reason entirely separate from that of meeting an air defense requirement, a budgetary situation came up that they wanted to meet in order to fulfill strategic deterrent objectives. They reshuffled the funds despite the fact that our committee had been advised last year that the master air defense plan was the very minimum effort that we could make.

Senator STENNIS. We might as well add, those funds were reshuffled and shifted in a step that may be sound, but the sad fact is that the commander, the man carrying the responsibility of Norad, was not even consulted. He just woke up one morning and the support was gone. That is about the description of it.

I want to emphasize that I want to compliment you on emphasizing that our foreign policy and military policy are linked together. They are inseparable. That is the new world we are living in. We don't much like it, but it is true. People don't realize that, I am afraid.

Senator JACKSON. Let me quote a brief statement in connection with the organization of the Department of Defense made by Mr. Lovett before our committee on February 23. I now quote:

> The number of committees in the Department of Defense and the military departments is still far too great. There is excessive staff layering.
>
> The constant increase in the number of committees—other than those statutorily created—has reached a point where they are no longer mere nuisances, but have become positive menaces to the prompt and orderly conduct of business.
>
> Some committees obviously are necessary—for example, certain interdepartmental ones—but I think it is fair to say that Dr. Parkinson's first law finds its best examples in this field. Committees reviewing other committees, overlapping them, are one of the most productive sources of vacillating administration and wavering policies.

I want to call attention to a request that our committee made of the Department of Defense on March 11. We asked for a list or breakdown of all of the committees in the Department of Defense.

Now, the list that they submitted which I have here contains 733 committees with 179 subcommittees. I hasten to all that this does not include classified committees or committees of the NSC–OCB mechanism. There are sample titles here, "Interservice Flight Vehicle Power Group," "Joint Master Menu Board," "Department of Army Accelerated Item Reduction Program Task Group," "Fiscal Sponsors Committee of the Toxicological Information Center."

May I ask this question Mr. Perkins: You heard my quotation from Mr. Lovett. Do you in general concur with what he said in his observations on this system that we have so graphically before us in this big, thick, heavy volume of Defense Department committees?

Dr. PERKINS. Fortunately, Senator, I do concur. It would be very hard not to in the face of that evidence. I think that a large establishment such as the Pentagon and the Federal Government is inevitably going to have an enormous number of committees in order to see to it that people in different branches of the Government worrying about the same problem are able to better understand and coordinate their efforts. I don't think that there is any conceivable way to abolish the committee idea. I am sure that nobody would suggest it.

I do think, however, that we have used a necessary instrument for administration frequently, all too frequently, as a way of dodging responsibility.

Senator JACKSON. It is an old American habit to refer a question to a committee, particularly if you don't know quite what you want to do with the question at that particular time. I suspect that half of these committees could stop work tomorrow and our policies would not suffer.

Would you like to make a distinction here among committees, ones where the chairman has authority to make a decision, and ones where they can meet and discuss and no one has the power to make a decision? Isn't that an important distinction?

Dr. PERKINS. It is, but I would have to ask a previous one, Senator, and that is what the committee was set up for. Now, if the committee is set up——

Senator JACKSON. I am assuming that it has a justifiable task and that the chairman or someone can make a decision after the matter has been thoroughly discussed.

Dr. PERKINS. Well, if a committee's work does not end up in administrative decision by somebody, somebody has wasted a lot of time. I would say that the committee system as a way of getting knowledge or of pooling knowledge is a very important device, particularly for people who work in very different departments. But the committee as a system for reaching administrative decisions is a terribly cumbersome device.

Senator STENNIS. If I may interpose here on this committee subject, during the debate on the civil rights bill we found we had 5½ pounds of bills. Now you have exceeded that record here in this list of Defense Department committees and you have more pounds of committees here on paper than we had bills in that 8 weeks' debate.

Senator JACKSON. Only the Pentagon can beat us out on paper effort.

I have some more questions, but I would like to turn to the minority counsel, Mr. Pendleton, for some questions.

Senator Mundt regretted that he could not be here, but he had a previous commitment, and Senator Javits, I believe is in Europe in connection with official business.

Mr. PENDLETON. I would like to join the Senators here in commending the prepared statement. It is excellent. I think you have done a fine job on this and made a real contribution. I particularly like your comment on the first page, that "there are no simple formulas for their solution." I sometimes think that that is overlooked.

Dr. PERKINS. There may be, sir, but I just haven't seen them.

Mr. PENDLETON. That shows a great wisdom in your approach to problems of this kind.

In your statement you refer to the organization of the Department of State. You say that—

> The global sweep of modern weapons makes it clear that foreign policy and military policy are inextricably linked. And yet there are few indications, indeed, that this fact has influenced either the organization or the procedures of the Department of State. There is no high official in the Department who has these considerations as his specific responsibility.

Are you aware of the appointment within the Department of State by Secretary Dulles of a U.S. representative on disarmament, a special assistant to the Secretary for disarmament and atomic energy, and a science adviser; and of continuation of the policy-planning group under Assistant Secretary Gerard Smith, from the tenure of earlier secretaries? Do you think this in any way applies to this problem?

Dr. PERKINS. Only fractionally. I am aware of the positions you have mentioned, and I would applaud every one of them. But I was referring especially to problems of military capability and strategy. I know the Secretary of State has had an assistant on atomic energy affairs for some time. That man, I am sure, has been most valuable to him. He is an adviser, however, dealing in a fairly limited although very important field.

Now, I was referring to the absence of anyone in the Department, and this is a point that I think was made by Mr. Bowie, a good friend of mine and recently director of the policy planning staff, where he

said that the Department was undermanned with people who had any kind of a considerable grounding in matters of military affairs and weaponry.

I was drawing a contrast between the absence of some such officer in the Department of State, and the presence of a similar opposite number in the Department of Defense, who is there specifically to see to it that the Defense Department considerations always take account of international matters, and that is the Assistant Secretary for International Security Affairs.

I was just suggesting that an officer with the same rank and the same status who for the Department of State could see to it that the top councils are continually made aware of the most current considerations of military strategy.

Mr. PENDLETON. Thank you.

Now, you are aware of Mr. Lovett's testimony before this committee, in which he said, and I quote:

> The policymaking machinery and procedures in the Department (of State) seem to me, in general terms, to be adequate.

He next replied in the negative in answer to the question:

> Should the Secretary be given a more dominant role in overall national security planning?

And a third question:

> Are the responsibilities of the State and Defense Departments in the national security policymaking now correctly defined, and divided?

And he said:

> I think they are adequately defined at present.

Now, you stated in your statement:

> There is not, as far as I know, any regular briefing of the top officials of the Department on the military component of our foreign policy. Junior officers do not attend military staff colleges in any significant numbers. If the military component is a decisive ingredient, there are few visible indications that the State Department has yet taken appropriate steps to develop the necessary internal expertise.

Have you participated in policymaking within the Department of State in recent years?

Dr. PERKINS. No, sir.

Mr. PENDLETON. You refer now to the fact that junior officers do not attend military staff colleges in any significant numbers.

Dr. PERKINS. I would like to be updated on the point, though. As a matter of fact, is the situation in the Department different than I have described?

Mr. PENDLETON. I am sorry, I am not qualified to testify as a witness. You are the expert here, sir.

Dr. PERKINS. Not on this point.

Senator JACKSON. I do not think Dr. Perkins claimed to be an expert on this point.

Mr. PENDLETON. You said junior officers do not attend staff college in any significant numbers. I am sure you did not intend to imply that there were no Department of State personnel who attended the War College.

Dr. PERKINS. I don't think that I would have used the phrase I did if I thought there were none. I am told that this year there are

six officers in the State Department who are currently attending the National War College. I think that this is far too few when you realize that there must be 8 to 10 times that number of military officers who are having identical experience. I would like to see that number increased or multiplied by a factor of four. I think 20 officers from the State Department are none too many to offset the expert training in this combination field that military officers are getting.

Mr. PENDLETON. Now, turning to the Department of Defense, where you referred to the organization there, are you aware of the statement of Mr. Lovett before this committee, in which he says:

> Taking the Department of Defense first, since it is freshest in my mind, I believe that adequate policymaking machinery in its special field is currently available; that proven operations machinery is in being; that it has, furthermore, the essential military attribute of close relationship between planning and operational responsibility * * *.

In that regard, I was wondering whether you were in favor of the action of Secretary Gates in deciding to sit in on meetings of the Joint Chiefs when a problem of controversial nature arose?

Dr. PERKINS. I am emphatically in favor of it. I am particularly pleased that he is doing it because I think that Mr. Gates, unlike his two predecessors, is bringing to discussions of the Joint Chiefs of Staff a wealth of experience within the Pentagon. I think Gates' move was a very wise one indeed, and I would applaud him for so doing.

Mr. PENDLETON. Now, you referred next, following your prepared statement, to a system—I am not sure of the words, and I don't have them before me, but I think that you will recognize them—a system that sets in advance a specific number of dollars which will be for the defense budget and no more beyond that. I was wondering what was the basis for your reference to that system? Have you participated recently in the policy planning that establishes policies for our defense budget?

Dr. PERKINS. No, I have not participated but I am fully aware of them. In this case let me be specific. As I understand it, the Air Force has been told that they should develop their plans for the next budgetary year on the assumption that their budget will be about the same as the current one, namely, about $18 billion. So here before they are asked what their requirements are to carry out the missions assigned to them, they are told to figure out their assignments in terms of an overall ceiling of $18 billion. So it will come as a surprise to no one when they come forward with their plans, that they will cost about $18 billion? In so doing, they will quietly and of necessity have to make a whole series of decisions not to do certain things, in order to live within this total figure. I know perfectly well what happens, because I am fairly closely connected with a good many people who are involved in this process. My concern about it, and I am sure you would share it, would be that people would be making decisions that would gravely affect our military capability without bringing to the surface what it is that they had decided not to do.

Senator JACKSON. If I might break in at that point, just for one moment, Dr. Perkins, just to clarify the record, you did serve as a member of the Gaither Committee and you did have an opportunity to look into the whole process, did you not?

Dr. PERKINS. Indeed I did, but the minority counsel asked if my experience was recent, and I had to answer no. I have participated but not within the last 2 or 3 years.

Senator JACKSON. So far as you know, there has been no change in that process?

Dr. PERKINS. On the contrary, I believe there are good reasons to believe there has been no change.

Mr. PENDLETON. Going to the question of the preparedness position at the present time, turning once more to Secretary Gates, are you aware of his statement before the Senate Committee on Aeronautical and Space Sciences, and the Preparedness Investigating Subcommittee of the Senate on March 16? In this he very briefly set out the position of the U.S. defense at the present time, based on a mixture between the ICBM, the Polaris, and SAC. Did you see any reports about that?

Dr. PERKINS. I saw it in the newspaper, but that is all.

Mr. PENDLETON. Mr. Chairman, in order to clarify the record and keep this before us, I would like without objection to have this inserted in the record, if it would be permissible.

Senator JACKSON. Do you want it at this point?

Mr. PENDLETON. Yes.

Senator JACKSON. Without objection, at this point the statement of Mrs. Smith which includes the statement from the Secretary of Defense, Thomas S. Gates, Jr., appearing on page 5425 of the Congressional Record of March 17, 1960, will be put in the record.

(The statement referred to follows:)

PREPAREDNESS AGAINST COMMUNIST THREAT

Mrs. SMITH. Mr. President, yesterday the Secretary of Defense appeared before the Senate Preparedness Investigating Subcommittee and made a statement which I feel should be brought to the attention not only of every Member of Congress but of every American. Consequently, I ask unanimous consent that it be printed in the body of the Record, and I invite everyone to read and study it.

There being no objection, the statement was ordered to be printed in the Record, as follows:

"STATEMENT BY THE SECRETARY OF DEFENSE, THOMAS S. GATES, JR., BEFORE THE PREPAREDNESS INVESTIGATING SUBCOMMITTEE OF THE SENATE COMMITTEE ON AERONAUTICAL AND SPACE SCIENCES, MARCH 16, 1960

"Mr. Chairman, I have a short statement. The major threat confronting us today is the persistent and relentless drive of communism toward an unchanged goal—a Communist controlled world. This threat is real and formidable. It encompasses all fields of human endeavor. It is military, political, economic, and psychological.

"It is important that we keep this complex threat in perspective. To do so we must examine each part in relationship to the whole.

"By the same token we must examine our own capabilities in the same manner. In the military field we must consider the entire picture and not an isolated part, regardless of how dramatic that part may be. Our military requirements must be based on our needs and consistent with national objectives. The Communist military requirements are vastly different. That is one reason we do not need to match the Communists bomber for bomber, missile for missile, division for division, or submarine for submarine.

"We need military strength which will convince the Communist leadership that no matter how hard it strikes it will be hit back so hard that its structure will collapse. An aggressor's destruction must be so inevitable that initiating war is tantamount to suicide. That strength I believe we have now, and our defense programs are designed to maintain this strength. This conviction is shared by my principal military and scientific advisers.

"First. Some of the facts which support this judgment are:

"(*a*) Our total strength, widely deployed within the United States and around the periphery of a single strategic target area, is so great that any surprise attack upon us would result in unacceptable destruction to the attacker. Contributing to this deterrent are tactical fighter bombers and light bombers plus tactical missiles and carrier attack aircraft in addition to the weapons of the Strategic Air Command.

"(*b*) The establishment of early warning systems, the capability for an airborne alert at the time and on the scale needed, and the deployment of mobile, hardened, and concealed missiles are progressing as planned. Our defense programs are under continuous review to insure that we maintain a long-range program of military strength. For example, we are accelerating the second BMEWS station to bring it into operation 4 months ahead of schedule.

"(*c*) Funds are included in the 1960 and 1961 budgets to provide an airborne alert capability for our heavy bombers. The extent of this effort is substantial: $142 million will be obligated this year and $85 million next year. This entails the procurement of extra engines and spare parts and the training of crews so that an airborne alert can be mounted if and when the need should arise. The Joint Chiefs of Staff and I agree that we do not need to fly airborne alert now but we do need the capability to do so during periods of tension which may lie ahead. The Congress has assisted this program by enacting section 612(b) in the 1960 Defense Appropriations Act which authorizes the incurring of deficiencies for this purpose. We are requesting reenacting of this provision in the 1961 act.

"(*d*) The intercontinental missile is a new and vitally important weapon that will profoundly affect the character of our problem. However, the threat it poses is not best countered by matching missile for missile. In fact, we must no allow ourselves to overconcentrate on any instrument of war. Rather the solution to our maintaining a valid and effective defense posture is by having in being a variety of types of weapons systems capable of successfully countering all types of threats facing us and our allies.

"Second. We have nuclear weapons that exceed those of the U.S.S.R. by several times in total destructive power. We have long-range means of delivery that exceeds theirs by several times in total carrying capacity. We have, in combination, enough to bring destruction to anyone who attacks us. We are designing our programs to maintain this strength.

"Last year we had available to us the national intelligence estimate which gave us the numbers of operational ICBM's which the U.S.S.R could achieve or might achieve in various time periods. These were calculated to cover either of two possibilities: One, that the Soviets would pursue a vigorous but orderly ICBM program, and the other, that they would pursue a highly accelerated or crash program.

"A year has now passed. Additional information has been acquired and further refinement has been accomplished. Considering all the available evidence, we believe it is now well established that the U.S.S.R. is not engaged in a crash program for ICBM development.

"Whether we take the estimate of a year ago or the current estimate, it is my firm judgment and that of my military and scientific advisers that our deterrent and retaliatory position remains adequate to meet the threat today and in the years ahead. We do not foresee a time when the Soviets could launch an attack on us without inviting unacceptable damage to themselves in return.

"I should also like to make it clear that neither General Twining nor I have been deprived of essential elements of intelligence, nor do I believe that our testimony indicates that we have been deprived of such essential elements.

"The flow of intelligence information and its assessment by the intelligence experts is a continuous process. General Twining and I are kept constantly informed on important developments in this area.

"Because they started much earlier and stayed persistently with the same program, the U.S.S.R. has booster engines, making possible exploration in deep space. Meanwhile, our Nation has had to telescope time in this effort. The lost years cannot be regained overnight, even though our scientists and engineers have worked wonders. For the years immediately ahead, it is important that we clearly differentiate space exploration from military weapons systems. At present the Department of Defense has no spcific military requirements for so-called superboosters. We are vitally interested in the development of larger boosters, because the future may well bring specific military requirements for them. Our

military satellite program is progressing as a matter of priority and is well supported by the propulsion systems of our ballistic missiles.

"Mr. Chairman, we are continuously reviewing our programs. We will not hesitate to come back to the Congress for additional funds at any time we feel such funds are required. We will not hesitate to take emergency measures. As of this time, I am convinced that we are on a sound basis and have presented a properly balanced concept. We will continue to plan and to change as necessary. We must always remain superior in total power. Along with the President, I am convinced that we will."

Mr. PENDLETON. Dr. Baxter, who appeared before this committee at an earlier session, made the following statment in regard to preparedness. He said:

I believe that at the present moment SAC, plus our nuclear strength overseas, plus our seaborne nuclear strength in the two fleets that we have on the ocean with it, is an adequate deterrent.

He said:

I would like to express my conviction, as vigorously as my friend Mr. Sprague did, that the United States today has a great military superiority over the Russians.

Do you disagree with this conclusion?

Dr. PERKINS. I don't think it is completely descriptive. Dr. Baxter is an eminent friend, and I think it is perfectly true that we have an enormous and very strong deterrent capability. I would be concerned with whether or not that ability is properly protected currently against an early strike or first strike capability of the Russians. You can have an enormous capability in being, but it must get off the ground. That capability may be in serious jeopardy if it is not properly sheltered or protected or dispersed against a surprise attack. This is an area in which technicians differ, if I read the public testimony of General Powers and others correctly. There are those in the Air Force who do not feel that this deterrent capability at the moment is properly dispersed or properly sheltered from the possibility of a Russian surprise attack.

Mr. PENDLETON. Now, do you feel that the successful launching of Pioneer V, Tiros, and Transit represent a substantial achievement of the scientific community of the United States?

Dr. PERKINS. Indeed it does.

Mr. PENDLETON. The last question is this: Do you believe that the Federal Government should rely for its scientific research primarily on outside resources or on scientific advice from within the Government?

Dr. PERKINS. I think it is always going to have to be both. I don't know what the percentages are, but I believe in the space field, roughly about 20 percent of its scientific resources are drawn from Government laboratories, and the remainder from industry and a small fraction from the universities.

Mr. PENDLETON. Thank you, Mr. Chairman.

Senator JACKSON. Just to follow up the question that Mr. Pendleton put to you, regarding our present deterrent capability, the witnesses at our previous meetings, four outstanding witnesses that we had, were in general agreement that we have the present deterrent capability, and I think that the point that you made is that it is not what you have before a first strike, it is what you will have after a first strike. That is the important thing.

Dr. PERKINS. Yes, sir.

Senator JACKSON. But there is another point that is significant, and Mr. Sprague in particular emphasized this. He felt that as to the future we were not doing enough, and that we were capable of doing more.

Now, isn't this the real problem, Dr. Perkins? It is not just what we have now, but will we have this survivable deterrent force next year, in 1962, or 1963, 1964? Must we not make sure that our resources are dedicated to that objective?

Dr. PERKINS. I could not agree more, Senator. I am told that we are in for a very critical set of years between now and, let us say, 1962, or 1963. The much advertised missile gap comes in there. We are told that there will be a large number of Russian intercontinental ballistics missiles in position and operational, or at least a larger number than we are likely to have.

But when you look to the future, this is an unstable world, Senator, and the difficulty is that as we increase our capabilities to defend ourselves from aggressive capabilities of potential enemies, we are by that same move increasing the instability derived from foreign fears of our own power.

I am terribly afraid, sir, that the instabilities are built into this system by the development of high-powered automatic response systems and in the instability of today is going to be infinitely worse within the next decade as we move from two-power deterrent systems to the spread of these weapons to other powers.

I don't think that we have even started to look hard at what kind of a strategic deterrent system the United States ought to have, if eight powers, for example, all possess ICBM's, with hydrogen warheads capable of flying 5,000 miles. In short, I think the time ahead of us is an unstable one indeed.

Senator JACKSON. I was interested in that statement, because in our earlier hearings Mr. Sprague made this statement:

> Advancing military technology is rapidly precipitating us into an unstable security position. Problems we now face and will increasingly face in the years ahead make it important that some significant changes be made in our organization for security.

Dr. PERKINS. I associate myself with that statement, and if a further authoritative voice is needed on this point, I recommend for those who have not read it a brilliant article by a RAND officer by the name of Wohlstetter. It was a piece that came out in Foreign Affairs just last year, called, "The Delicate Balance of Terror." This piece, if it is not in your records somewhere, should be, Senator, because I think that this is an important analysis that we have built-in instabilities in the the deterrent picture we now have.

Senator JACKSON. If there is no objection, maybe you would like to include that statement in the record.

Dr. PERKINS. I would like very much to see that piece put in at the conclusion of my remarks. (See p. 268.)

Senator JACKSON. You have an article that you wrote in 1953, in this general area.

Dr. PERKINS. Modesty prevents me from pushing this on you, Senator.

Senator JACKSON. If there is no objection, that will be included with the other article. What is the title of it?

Dr. PERKINS. The title is "The Administration of the National Security Program," written in 1953.

Senator JACKSON. Without objection, that will be included in the record. (See p. 281.)

Senator JACKSON. Senator Robertson asked you—and I take it that you have not changed your views since you served on the Gaither Committee—about our overall national security requirements.

Dr. PERKINS. I have no reason to, sir.

Senator JACKSON. On this point I want to ask you what reflections you might have on the value and the proper use of distinguished citizens' committees. Would you care to comment on that subject? You have served on the Gaither Committee.

Dr. PERKINS. Well, I think that, like all things, there is a plus and a minus to them. Let me deal with the plus first. I don't think that they were designed for this purpose, but they have been a way of bringing into the discourse of very important matters in the field of national security a wide band of citizens who otherwise would not have had a chance to become familiar and concerned with these problems. In short, I think it has been a device for public education, if I can use that word, by which we have seen to it that a large number of people in private life have for at least a short space of time had a very thorough grounding in some of the central problems of national security.

Now, I think in our kind of a country this has been all to the good. It has been, of course, one of the stickiest issues we have as to how matters that have to go on protected by such close attention to security, how these matters can be gotten to an informed citizenry.

So I think that the citizens' committee, like the Gaither group and the Draper Committee and others that during the last year have been created to tackle public problems, I think that they have been an enormously important factor as a way of seeing to it that maybe as many as 100 or 200 people who otherwise would have had little chance to come very close to these problems have had that chance.

The difficulty is that they are frequently put together to answer problems or to come up with answers to problems that have not been resolved within the regular system itself. One has to ask—and I think it is proper to ask—what happened in the system that did not produce the kind of answer that was expected of a citizens' committee. Was it that they really wanted some fresh ideas, or was it that the problem was so complicated that the existing machinery did not deal with it, or was it possible that the solution of the problem involved such major and drastic changes in our security programs and allocations of funds that this could only be thought of by bringing in an outside group? So I think that on this particular score there have been important ideas that have come out of these committees. People that have worked on them have almost unanimously come back with strong feelings of increased effort that have had to be made in various parts of our programs. This has been true of the Draper Committee that just finished its labors, and it was true of some of the earlier ones.

Now, the question, sir, and I am sure it must be one on your mind, is how can the conclusions of these citizens' groups have a greater

impact on our established policies. I think there is no easy answer to this, other than the willingness of the managers of the programs themselves or the machinery itself to rethink in fairly radical ways the normal postulates under which they have been operating. There is no system on earth, Senator, or none on earth that I know of, that will force people to make wise decisions. If the managers are really in the market for fresh ideas, and are really prepared to reexamine some of the premises under which they have been operating, then I think that the citizens' group can produce the ideas. Without it is an interesting experience in adult education and an interesting experience for perhaps mobilizing public support for certain programs in the military assistance field, but as far as seeing to it that new ideas get into the actual decisionmaking apparatus, the citizens committee is no better than the people who use them.

Senator JACKSON. Then it does reveal, as you point out, that if the existing machinery in government had been functioning properly, and I say this without criticism of any administration because citizens committees have been used by all administrations, there would be no need for them. Is this a fair statement?

Dr. PERKINS. Only on the part that I mentioned, Senator, there would be no need for it if the system was devised to continually inject new and fresh ideas into existing programs.

Senator JACKSON. That is bringing in consultants and outsiders, and so on.

Dr. PERKINS. Yes, sir.

Senator JACKSON. In your judgment, what has been the record of implementation of these recommendations of the distinguished citizens committee?

Dr. PERKINS. Well, I don't know how far I would be getting into privileged information by answering this.

Senator JACKSON. I mean in general—many specific details are privileged matters. I am merely referring as a general proposition, to distinguished committees in general.

Dr. PERKINS. I would say in general the implementation has been relatively slight.

Senator JACKSON. In other words, a long series of recommendations are made but when it comes down to the actual implementation there has not been a substantial record of implementation of the views expressed and the recommendations made by distinguished citizens committees.

Dr. PERKINS. I would have to add, and I am sure you would agree with me, that because a distinguished citizens committee made a recommendation it is not necessarily a wise thing for the Government to implement it.

Senator JACKSON. I agree, but I am pointing out that these people engage in a lot of work, and hard effort, and I think the citizens who have served on these committees hardly without exception have been distinguished as to their competency to make recommendations in their field.

Dr. PERKINS. That is right.

Senator JACKSON. This is generally true; is it not?

Dr. PERKINS. Yes; it is. Even if no recommendation were ever specifically accepted at all, I would still argue that they be continued as a way of seeing to it that some of our national leaders are brought

within this picture. This might be basis enough alone to proceed with them.

Senator JACKSON. Mr. Reynolds, the staff director of the Government Operations Committee, has called to my attention an article by Senator Hubert Humphrey that appears in the January 1960 issue of the Annals in which he makes comments on the committee system, interdepartmental committees. Without objection that statement which was called to my attention by Mr. Reynolds will be placed in the record at this point in connection with the discussion on the subject of the committee system.

Senator Hubert H. Humphrey pointed out, in an article which appeared in the January 1960 issue of the Annals of the American Academy of Political and Social Science—

Those who place their reliance on coordinating devices such as interagency committees for improving communications and for providing stimulus to Government science activities fail to recognize the built-in limitations of these approaches. By their very nature interagency committees cannot be creative except at a very low level of operation. They are inevitably restricted by the view of the most pedestrian and unimaginative members. Their product will almost certainly be a kind of lowest common denominator of their combined ideas. What is needed is dynamic, forceful, and continuing leadership which could best come from a Cabinet department with clear-cut responsibility and authority in the field of science and technology.

Mr. PENDLETON. I have just one question. You do feel that the President, the occupant of that position, should make his own policy decisions after receiving advice from his people in Government and outside of the Government?

Dr. PERKINS. Of course.

Mr. PENDLETON. Thank you.

Senator JACKSON. The sole purpose of setting up these committees is to try to make available to the President advice which fulfills the directives given to the distinguished citizens committees by the President himself; is this not true?

Dr. PERKINS. He could not give them power if he wanted to. They would not serve if he gave it to them.

Senator JACKSON. Are there any further questions on that?

If not, the open session of the committee will come to a close, and we will convene in executive session and give Mr. Perkins an opportunity to cover the matter of the National Security Council.

(Whereupon, at 12:25 p.m., the committee proceeded to further business in executive session.)

[From Foreign Affairs, January, 1959]

THE DELICATE BALANCE OF TERROR

By Albert Wohlstetter

The first shock administered by the Soviet launching of sputnik has almost dissipated. The flurry of statements and investigations and improvised responses has died down, leaving a small residue: a slight increase in the schedule of bomber and ballistic missile production, with a resulting small increment in our defense expenditures for the current fiscal year; a considerable enthusiasm for space travel; and some stirrings of interest in the teaching of mathematics and physics in the secondary schools. Western defense policy has almost returned to the level of activity and the emphasis suited to the basic assumptions which were controlling before sputnik.

One of the most important of these assumptions—that a general thermonuclear war is extremely unlikely—is held in common by most of the critics of our defense policy as well as by its proponents. Because of its crucial rôle in

the Western strategy of defense, I should like to examine the stability of the thermonuclear balance which, it is generally supposed, would make aggression irrational or even insane. The balance, I believe, is in fact precarious, and this fact has critical implications for policy. Deterrence in the 1960's is neither assured nor impossible but will be the product of sustained intelligent effort and hard choices, responsibly made. As a major illustration important both for defense and foreign policy, I shall treat the particularly stringent conditions for deterrence which affect forces based close to the enemy, whether they are U.S. forces or those of our allies, under single or joint control. I shall comment also on the inadequacy as well as the necessity of deterrence, on the problem of accidental outbreak of war, and on disarmament.[1]

II. THE PRESUMED AUTOMATIC BALANCE

I emphasize that requirements for deterrence are stringent. We have heard so much about the atomic stalemate and the receding probability of war which it has produced that this may strike the reader as something of an exaggeration. Is deterrence a necessary consequence of both sides having a nuclear delivery capability, and is all-out war nearly obsolete? Is mutual extinction the only outcome of a general war? This belief, frequently expressed by references to Mr. Oppenheimer's simile of the two scorpions in a bottle, is perhaps the prevalent one. It is held by a very eminent and diverse group of people—in England by Sir Winston Churchill, P. M. S. Blackett, Sir John Slessor, Admiral Buzzard and many others; in France by such figures as Raymond Aron, General Gallois and General Gazin; in this country by the titular heads of both parties as well as almost all writers on military and foreign affairs, by both Henry Kissinger and his critic, James E. King, Jr., and by George Kennan as well as Dean Acheson. Mr. Kennan refers to American concern about surprise attack as simply obsessive;[2] and many people have drawn the consequence of the stalemate as has Blackett, who states: "If it is in fact true, as most current opinion holds, that strategic air power has abolished global war, then an urgent problem for the West is to assess how little effort must be put into it to keep global war abolished."[3] If peace were founded firmly on mutual terror, and mutual terror on symmetrical nuclear capabilities, this would be, as Churchill has said, "a melancholy parodox;" none the less a most comforting one.

Deterrence, however, is not automatic. While feasible, it will be much harder to achieve in the 1960's than is generally believed. One of the most disturbing features of current opinion is the underestimation of this difficulty. This is due partly to a misconstruction of the technological race as a problem in matching striking forces, partly to a wishful analysis of the Soviet ability to strike first.

Since sputnik, the United States has made several moves to assure the world (that is, the enemy, but more especially our allies and ourselves) that we will match or overmatch Soviet technology and, specifically, Soviet offense technology. We have, for example, accelerated the bomber and ballistic missile programs, in particular the intermediate-range ballistic missiles. The problem has been conceived as more or better bombers—or rockets; or sputniks; or engineers. This has meant confusing deterrence with matching or exceeding the enemy's ability to strike first. Matching weapons, however, misconstrues the nature of the technological race. Not, as is frequently said, because only a few bombs owned by the defender can make aggression fruitless, but because even many might not. One outmoded A-bomb dropped from an obsolete bomber might destroy a great many supersonic jets and ballistic missiles. To deter an attack means being able to strike back in spite of it. It means, in other words, a capability to strike second. In the last year or two there has been a growing awareness of the importance of the distinction between a "strike-first" and a "strike-second" capability, but little, if any, recognition of the implications of this distinction for the balance of terror theory.

Where the published writings have not simply underestimated Soviet capabilities and the advantages of a first strike, they have in general placed artificial constraints on the Soviet use of the capabilities attributed to them. They as-

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[1] I want to thank C. J. Hitch, M. W. Hoag, W. W. Kaufman, A. W. Marshall, H. S. Rowen, and W. W. Taylor for suggestions in preparation of this article.

[2] George F. Kennan, "A Chance to Withdraw Our Troops in Europe," *Harper's Magazine*, February 1958, p. 41.

[3] P. M. S. Blackett, "Atomic Weapons and East-West Relations" (New York: Cambridge University Press, 1956), p. 32.

sume, for example, that the enemy will attack in mass over the Arctic through our Distant Early Warning line, with bombers refueled over Canada—all resulting in plenty of warning. Most hopefully, it is sometimes assumed that such attacks will be preceded by days of visible preparations for moving ground troops. Such assumptions suggest that the Soviet leaders will be rather bumbling or, better, cooperative. However attractive it may be for us to narrow Soviet alternatives to these, they would be low in the order of preference of any reasonable Russians planning war.

III. THE QUANTITATIVE NATURE OF THE PROBLEM AND THE UNCERTAINTIES

In treating Soviet strategies it is important to consider Soviet rather than Western advantage and to consider the strategy of both sides quantitatively. The effectiveness of our own choices will depend on a most complex numerical interaction of Soviet and Western plans. Unfortunately, both the privileged and unprivileged information on these matters is precarious. As a result, competent people have been led into critical error in evaluating the prospects for deterrence. Western journalists have greatly overestimated the difficulties of a Soviet surprise attack with thermonuclear weapons and vastly underestimated the complexities of the Western problem of retaliation.

One intelligent commentator, Richard Rovere, recently expressed the common view: "If the Russians had ten thousand war heads and a missile for each, and we had ten hydrogen bombs and ten obsolete bombers, . . . aggression would still be a folly that would appeal only to an insane adventurer." Mr. Rovere's example is plausible because it assumes implicitly that the defender's hydrogen bombs will with certainty be visited on the aggressor; then the damage done by the ten bombs seems terrible enough for deterrence, and any more would be simply redundant. This is the basis for the common view. The example raises questions, even assuming the delivery of the ten weapons. For instance, the targets aimed at in retaliation might be sheltered and a quite modest civil defense could hold within tolerable limits the damage done to such city targets by ten delivered bombs. But the essential point is that the weapons would not be very likely to reach their targets. Even if the bombers were dispersed at ten different points, and protected by shelters so blast resistant as to stand up anywhere outside the lip of the bomb crater—even inside the fire ball itself—the chances of one of these bombers surviving the huge attack directed at it would be on the order of one in a million. (This calculation takes account of the unreliability and inaccuracy of the missile.) And the damage done by the small minority of these ten planes that might be in the air at the time of the attack, armed and ready to run the gauntlet of an alert air defense system, if not zero, would be very small indeed compared to damage that Russia has suffered in the past. For Mr. Rovere, like many other writers on this subject, numerical superiority is not important at all.

For Joseph Alsop, on the other hand, it is important, but the superiority is on our side. Mr. Alsop recently enunciated as one of the four rules of nuclear war: "The aggressor's problem is astronomically difficult; and the aggressor requires an overwhelming superiority of force."[4] There are, he believes, no fewer than 400 SAC bases in the NATO nations alone and many more elsewhere, all of which would have to be attacked in a very short space of time. The "thousands of coordinated air sorties and/or missile firings," he concludes, are not feasible. Mr. Alsop's argument is numerical and has the virtue of demonstrating that at least the realtive numbers are important. But the numbers he uses are very wide of the mark. He overestimates the number of such bases by a factor of more than 10,[5] and in any case, missile firings on the scale of a thousand or more involve costs that are by no means out of proportion, given the strategic budgets of the great powers. Whether or not thousands are needed depends on the yield and the accuracy of the enemy missiles, something about which it would be a great mistake for us to display confidence.

Perhaps the first step in dispelling the nearly universal optimism about the stability of deterrence would be to recognize the difficulties in analyzing the uncertainties and interactions between our own wide range of choices and the moves open to the Soviets. On our side we must consider an enormous variety

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[4] Joseph Alsop, "The New Balance of Power," *Encounter*, May 1958, p. 4. It should be added that, since these lines were written, Mr. Alsop's views have altered.

[5] *The New York Times*, September 6, 1958, p. 2.

of strategic weapons which might compose our force, and for each of these several alternative methods of basing and operation. These are the choices that determine whether a weapons system will have any genuine capability in the realistic circumstances of a war. Besides the B–47E and the B–52 bombers which are in the U.S. strategic force now, alternatives will include the B–52G (a longer-range version of the B–52); the Mach 2 B–58A bomber and a "growth" version of it; the Mach 3 B–70 bomber; a nuclear-powered bomber possibly carrying long-range air-to-surface missiles; the Dynasoar, a manner glide-rocket; the Thor and the Jupiter, liquid-fueled intermediate-range ballistic missiles; the Snark intercontinental cruise missile; the Atlas and the Titan intercontinental ballistic missiles; the submarine-launched Polaris and Atlantis rockets; and Minuteman, one potential solid-fueled successor to the Thor and Titan; possibly unmanned bombardment satellites; and many others which are not yet gleams in anyone's eye and some that are just that.

The difficulty of describing in a brief article the best mixture of weapons for the long-term future beginning in 1960, their base requirements, their potentiality for stabilizing or upsetting the balance among the great powers, and their implications for the alliance, is not just a matter of space or the constraint of security. The difficulty in fact stems from some rather basic insecurities. These matters are widely uncertain; we are talking about weapons and vehicles that are some time off and, even if the precise performances currently hoped for and claimed by contractors were in the public domain, it would be a good idea to doubt them.

Recently some of my colleagues picked their way through the graveyard of early claims about various missiles and aircraft: their dates of availability, costs and performance. These claims are seldom revisited or talked about: *de mortuis nil nisi bonum*. The errors were large and almost always in one direction. And the less we knew, the more hopeful we were. Accordingly the missiles benefited in particular. For example, the estimated cost of one missile increased by a factor of over 50—from about $35,000 in 1949 to some $2 million in 1957. This uncertainty is critical. Some but not all of the systems listed can be chosen and the problem of choice is essentially quantitative. The complexities of the problem, if they were more widely understood, would discourage the oracular confidence of writers on the subject of deterrence.

Some of the complexities can be suggested by referring to the successive obstacles to be hurdled by any system providing a capability to strike second, that is, to strike back. Such deterrent systems must have (a) a stable, "steady-state" peacetime operation within feasible budgets (besides the logistic and operational costs there are, for example, problems of false alarms and accidents). They must have also the ability (b) to survive enemy attacks, (c) to make and communicate the decision to retaliate, (d) to reach enemy territory with fuel enough to complete their mission, (e) to penetrate enemy active defenses, that is, fighters and surface-to-air missiles, and (f) to destroy the target in spite of any "passive" civil defense in the form of dispersal or protective construction or evacuation of the target itself.

Within limits the enemy is free to use his offensive and defensive forces so as to exploit the weaknesses of each of our systems. He will also be free, within limits, in the 1960s to choose that composition of forces which will make life as difficult as possible for the various systems we might select. It would be quite wrong to assume that we have the same degree of flexibility, or that the uncertainties I have described affect a totalitarian aggressor and the party attacked equally. A totalitarian country can preserve secrecy about the capabilities and disposition of his forces very much better than a Western democracy. And the aggressor has, among other enormous advantages of the first strike, the ability to weigh continually our performance at each of the six barriers and to choose that precise time and circumstance for attack which will reduce uncertainty. It is important not to confuse our uncertainty with his. Strangely enough, some military commentators have not made this distinction and have founded their certainty of deterrence on the fact simply that there are uncertainties.

Unwarranted optimism is displayed not only in the writings of journalists but in the more analytic writings of professionals. The recent writings of General Gallois[6] parallel rather closely Mr. Alsop's faulty numerical proof that sur-

[6] General Pierre M. Gallois, "A French General Analyzes Nuclear-Age Strategy," *Réalités*, Nov. 1958, p. 19; "Nuclear Aggression and National Suicide," *The Reporter*, Sept. 18, 1958, p. 23.

prise attack is astronomically difficult—except that Gallois' "simple arithmetric," to borrow his own phrase, turns essentially on some assumptions which are at once inexplicit and extremely optimistic with respect to the blast resistance of dispersel missile sites subjected to attack from relatively close range.[7] Mr. Blackett's recent book, "Atomic Weapons and East-West Relations," illustrates the hazards confronting a most able analyst in dealing with the piecemeal information available to the general public. Mr. Blackett, a Nobel prize-winning physicist with wartime experience in military operations research, lucidly summarized the public information available when he was writing in 1956 on weapons for all-out war. But much of his analysis was based on the assumption that H-bombs could not be made small enough to be carried in an intercontinental missile. It is now widely known that intercontinental ballistic missiles will have hydrogen warheads, and this fact, a secret at the time, invalidates, Mr. Blackett's calculations and, I might say, much of his optimism on the stability of the balance of terror. In sum, one of the serious obstacles to any widespread rational judgment on these matters of high policy is that critical elements of the problem *have* to be protected by secrecy. However, some of the principal conclusions about deterrence in the early 1960s can be fairly firmly based, and based on public information.

IV. THE DELICACY OF THE BALANCE OF TERROR

The most important conclusion is that we must expect a vast increase in the weight of attack which the Soviets can deliver with little warning, and the growth of a significant Russian capability for an essentially warningless attack. As a result, strategic deterrence, while feasible, will be exteremely difficult to achieve, and at critical junctures in the 1960s, we may not have the power to deter attack. Whether we have it or not will depend on some difficult strategic choices as to the future composition of the deterrent forces as well as hard choices on its basing, operations and defense.

Manned bombers will continue to make up the predominant part of our striking force in the early 1960s. None of the popular remedies for their defense will suffice—not, for example, mere increase of alertness (which will be offset by the Soviet's increasing capability for attack without significant warning), nor simple dispersal or sheltering alone or mobility taken by itself, nor a mere piling up of interceptors and defense missiles around SAC bases. Especially extravagant expectations have been placed on the airborne alert—an extreme form of defense by mobility. The impression is rather widespread that one-third of the SAC bombers are in the air and ready for combat at all times.[8] This belief is belied by the public record. According to the Symington Committee Hearings in 1956, our bombers averaged 31 hours of flying per month, which is about 4 percent of the average 732-hour month. An Air Force representative expressed the hope that within a couple of years, with an increase in the ratio of crews to aircraft, the bombers would reach 45 hours of flight per month—which is 6 percent. This 4 to 6 percent of the force includes bombers partially fueled and without bombs. It is, moreover, only an average, admitting variance down as well as up. Some increase in the number of armed bombers aloft is to be expected. However, for the current generation of bombers, which have been designed for speed and range rather than endurance, a continuous air patrol for one-third of the force would be extremely expensive.

On the other hand, it would be unwise to look for miracles in the new weapons systems, which by the mid-1960s may constitute a considerable portion of the United States force. After the Thor, Atlas and Titan there are a number of promising developments. The solid-fueled rockets, Minuteman and Polaris, promise in particular to be extremely significant components of the deterrent force. Today they are being touted as making the problem of deterrence easy to solve and, in fact, guaranteeing its solution. But none of the new developments in vehicles is likely to do that. For the complex job of deterrence, they all have limitations. The unvaryingly immoderate claims for each new weapons system should make us wary of the latest "technological breakthroughs." Only a very short time ago the ballistic missile itself was supposed to be intrinsically

[7] See footnote, p. 278.

[8] See, for example, "NATO, A Critical Appraisal," by Gardner Patterson and Edgar S. Furniss, Jr., Princeton University Conference on NATO, Princeton, June 1957, p. 32: "Although no one pretended to know, the hypothesis that one-third of the striking force of the United States Strategic Air Command was in the air at all times was regarded by most as reasonable."

invulnerable on the ground. It is now more generally understood that its survival is likely to depend on a variety of choices in its defense.

It is hard to talk with confidence about the mid and late-1960s. A systematic study of an optimal or a good deterrent force which considered all the major factors affecting choice and dealt adequately with the uncertainties would be a formidable task. In lieu of this, I shall mention briefly why none of the many systems available or projected dominates the others in any obvious way. My comments will take the form of a swift run-through of the characteristic advantages and disadvantages of various strategic systems at each of the six successive hurdles mentioned earlier.

The first hurdle to be surmounted is the attainment of a stable, steady-state peacetime operation. Systems which depend for their survival on extreme decentralization of controls, as may be the case with large-scale dispersal and some of the mobile weapons, raise problems of accidents and over a long period of peacetime operation this leads in turn to serious political problems. Systems relying on extensive movement by land, perhaps by truck caravan, are an obvious example; the introduction of these on European roads, as is sometimes suggested, would raise grave questions for the governments of some of our allies. Any extensive increase in the armed air alert will increase the hazard of accident and intensify the concern already expressed among our allies. Some of the proposals for bombardment satellites may involve such hazards of unintended bomb release as to make them out of the question.

The cost to buy and operate various weapons systems must be seriously considered. Some systems buy their ability to negotiate a given hurdle—say, surviving the enemy attack—only at prohibitive cost. Then the number that can be bought out of a given budget will be small and this will affect the relative performance of competing systems at various other hurdles, for example penetrating enemy defenses. Some of the relevant cost comparisons, then, are between competing systems; others concern the extra costs to the enemy of canceling an additional expenditure of our own. For example, some dispersal is essential, though usually it is expensive; if the dispersed bases are within a warning net, dispersal can help to provide warning against some sorts of attack, since it forces the attacker to increase the size of his raid and so makes it more liable to detection as well as somewhat harder to coördinate. But as the sole or principal defense of our offensive force, dispersal has only a brief useful life and can be justified financially only up to a point. For against our costs of construction, maintenance. and operation of an additional base must be set the enemy's much lower costs of delivering one extra weapon. And, in general, any feasible degree of dispersal leaves a considerable concentration of value at a single target point. For example, a squadron of heavy bombers costing, with their associated tankers and penetration aids, perhaps $500,000,000 over five years, might be eliminated, if it were otherwise unprotected, by an enemy intercontinental ballistic missile costing perhaps $16,000,000. After making allowance for the unreliability and inaccuracy of the missile, this means a ratio of some ten for one or better. To achieve safety by *brute* numbers in so unfavorable a competition is not likely to be viable economically or politically. However, a viable peacetime operation is only the first hurdle to be surmounted.

At the second hurdle—surviving the enemy offense—ground alert systems placed deep within a warning net look good against a manned bomber attack, much less good against intercontinental ballistic missiles, and not good at all against ballistic missiles launched from the sea. In the last case, systems such as the Minuteman, which may be sheltered and dispersed as well as alert, would do well. Systems involving launching platforms which are mobile and concealed, such as Polaris submarines, have particular advantage for surviving an enemy offense.

However, there is a third hurdle to be surmounted—namely that of making the decision to retaliate and communicating it. Here, Polaris, the combat air patrol of B–52s, and in fact all of the mobile platforms—under water, on the surface, in the air and above the air—have severe problems. Long distance communication may be jammed and, most important, communication centers may be destroyed.

At the fourth hurdle—ability to reach enemy territory with fuel enough to complete the mission—several of our short-legged systems have operational problems such as coordination with tankers and using bases close to the enemy. For a good many years to come, up to the mid-1960's in fact, this will be a formidable hurdle for the greater part of our deterrent force. The next section of this article deals with this problem at some length.

The fifth hurdle is the aggressor's long-range interceptors and close-in missile defenses. To get past these might require large numbers of planes and missiles. (If the high cost of overcoming an earlier obstacle—using extreme dispersal or airborne alert or the like—limits the number of planes or missiles bought, our capability is likely to be penalized disproportionately here.) Or getting through may involve carrying heavy loads of radar decoys, electronic jammers and other aids to defense penetration. For example, vehicles like Minuteman and Polaris, which were made small to facilitate dispersal or mobility, may suffer here because they can carry fewer penetration aids.

At the final hurdle—destroying the target in spite of the passive defenses that may protect it—low-payload and low-accuracy systems, such as Minuteman and Polaris, may be frustrated by blast-resistant shelters. For example, five half-megaton weapons with an average inaccuracy of two miles might be expected to destroy half the population of a city of 900,000, spread over 40 square miles, provided the inhabitants are without shelters. But if they are provided with she'ters capable of resisting over-pressures of 100 pounds per square inch, approximately 60 such weapons would be required; and deep rock shelters might force the total up to over a thousand.

Prizes for a retaliatory capability are not distributed for getting over one of these jumps. A system must get over all six. I hope these illustrations will suggest that assuring ourselves the power to strike back after a massive thermonuclear surprise attack is by no means as automatic as is widely believed.

In counteracting the general optimism as to the ease and, in fact, the inevitability of deterrence, I should like to avoid creating the extreme opposite impression. Deterrence demands hard, continuing, intelligent work, but it can be achieved. The job of deterring rational attack by guaranteeing great damage to an aggressor is, for example, very much less difficult than erecting a nearly air-tight defense of cities in the face of full-scale thermonuclear surprise attack. Protecting manned bombers and missiles is much easier because they may be dispersed, sheltered or kept mobile, and they can respond to warning with greater speed. Mixtures of these and other defenses with complementary strengths can preserve a powerful remainder after attack. Obviously not all our bombers and missiles need to survive in order to fulfill their mission. To preserve the majority of our cities intact in the face of surprise attack is immensely more difficult, if not impossible. (This does not mean that the aggressor has the same problem in preserving his cities from retaliation by a poorly-protected, badly-damaged force. And it does not mean that *we* should not do more to limit the extent of the catastrophe to our cities in case deterrence fails. I believe we should.) Deterrence, however, provided we work at it, is feasible, and, what is more, it is a crucial objective of national policy.

What can be said, then, as to whether general war is unlikely? Would not a general themonuclear war mean "extinction" for the aggressor as well as the defender? "Extinction" is a state that badly needs analysis. Russian casualties in World War II were more than 20 million. Yet Russia recovered extremely well from this catastrophe. There are several quite plausible circumstances in the future when the Russians might be quite confident of being able to limit damage to considerably less than this number—if they make sensible strategic choices and we do not. On the other hand, the risks of not striking might at some juncture appear very great to the Soviets, involving, for example, disastrous defeat in peripheral war, loss of key satellites with danger of revolt spreading—possibly to Russia itself—or fear of an attack by ourselves. Then, striking first, by surprise, would be the sensible choice for them, and from their point of view the smaller risk.

It should be clear that it is not fruitful to talk about the likelihood of general war without specifying the range of alternatives that are pressing on the aggressor and the strategic postures of both the Soviet bloc and the West. Deterrence is a matter of comparative risks. The balance is not automatic. First, since themonuclear weapons give an enormous advantage to the aggressor, it takes great ingenuity and realism at any given level of nuclear technology to devise a stable equilibrium. And second, this technology itself is changing with fantastic speed. Deterrence will require an urgent and continuing effort.

V. THE USES AND RISKS OF BASES CLOSE TO THE SOVIETS

It may now be useful to focus attention on the special problems of deterrent forces close to the Soviet Union. First, overseas areas have played an important role in the past and have a continuing though less certain role today.

Second, the recent acceleration of production of intermediate-range ballistic missiles and the negotiation of agreements with various NATO powers for their basing and operation have given our overseas bases a renewed importance in deterring attack on the United States—or so it would appear at first blush. Third, an analysis can throw some light on the problems faced by our allies in developing an independent ability to deter all-out attack on themselves, and in this way it can clarify the much agitated question of nuclear sharing. Finally, overseas bases affect in many critical ways, political and economic as well as military, the status of the alliance.

At the end of the last decade, overseas bases appeared to be an advantageous means of achieving the radius extension needed by our short-legged bombers, of permitting them to use several axes of attack, and of increasing the number of sorties possible in the course of an extended campaign. With the growth of our own thermonuclear stockpile, it became apparent that a long campaign involving many re-uses of a large proportion of our bombers was not likely to be necessary. With the growth of a Russian nuclear-delivery capability, it became clear that this was most unlikely to be feasible.

Our overseas bases now have the disadvantage of high vulnerability. Because they are closer than the United States to the Soviet Union, they are subject to a vastly greater attack by a larger variety as well as number of vehicles. With given resources, the Soviets might deliver on nearby bases a freight of bombs with something like 50 to 100 times the yield that they could muster at intercontinental range. Missile accuracy would more than double. Because there is not much space for obtaining warning—in any case, there are no deep-warning radar nets—and, since most of our overseas bases are close to deep water from which submarines might launch missiles, the warning problem is very much more severe than for bases in the interior of the United States.

As a result, early in the 1950's the U.S. Air Force decided to recall many of our bombers to the continental United States and to use the overseas bases chiefly for refueling, particularly poststrike ground refueling. This reduced drastically the vulnerability of U.S. bombers and at the same time retained many of the advantages of overseas operation. For some years now SAC has been reducing the number of aircraft usually deployed overseas. The purpose is to reduce vulnerability and has little to do with any increasing radius of SAC aircraft. The early B–52 radius is roughly that of the B–36; the B–47, roughly that of the B–50 or B–29. In fact the radius limitation and therefore the basing requirements we have discussed will not change substantially for some time to come. We can talk with comparative confidence here, because the U.S. strategic force is itself largely determined for this period. Such a force changes more slowly than is generally realized. The vast majority of the force will consist of manned bombers, and most of these will be of medium range. *Some* U.S. bombers will be able to reach *some* targets from *some* U.S. bases within the 48 states without landing on the way back. On the other hand, some bomber-target combinations are not feasible without pre-target landing (and are therefore doubtful). The Atlas, Titan, and Polaris rockets, when available, can of course do without overseas bases (though the proportion of Polaris submarines kept at sea can be made larger by the use of submarine tenders based overseas). But even with the projected force of aerial tankers, the greater part of our force, which will be manned bombers, cannot be used at all in attacks on the Soviet Union without at least some use of overseas areas.

What of the bases for Thor and Jupiter, our first intermediate-range ballistic missiles? These have to be close to the enemy, and they must of course be operating bases, not merely refueling stations. The Thors and Jupiters will be continuously in range of an enormous Soviet potential for surprise attack. These installations therefore re-open, in a most acute form, some of the serious questions of ground vulnerability that were raised about six years ago in connection with our overseas bomber bases. The decision to station the Thor and Jupiter missiles overseas has been our principal public response to the Russian advances in rocketry, and perhaps our most plausible response. Because it involves our ballistic missiles it appears directly to answer the Russian rockets. Because it involves using European bases, it appears to make up for the range superiority of the Russian intercontinental missile. And most important, it directly involves the NATO powers and gives them an element of control.

There is no question that it was genuinely urgent not only to meet the Russian threat but to do so visibly, in order to save the loosening NATO alliance. Our allies were fearful that the Soviet ballistic missiles might mean that we were

no longer able or willing to retaliate against the Soviet Union in case of an attack on them. We hastened to make public a reaction which would restore their confidence. This move surely appears to increase our own power to strike back, and also to give our allies a deterrent of their own, independent of our decision. It has also been argued that in this respect it merely advances the inevitable date at which our allies will acquire "modern" weapons of their own, and that it widens the range of Soviet challenges which Europe can meet. But we must face seriously the question whether this move will in fact assure either the ability to retaliate or the decision to attempt it, on the part of our allies or ourselves. And we should ask at the very least whether further expansion of this policy will buy as much retaliatory power as other ways of spending the considerable sums involved. Finally, it is important to be clear whether the Thor and Jupiter actually increase the flexibility or range of response available to our allies.

One justification for this move is that it disperses retaliatory weapons and that this is the most effective sanction against the thermonuclear aggressor. The limitations of dispersal have already been discussed, but it remains to examine the argument that overseas bases provide *widespread* dispersal, which imposes on the aggressor insoluble problems of coordination.

There is of course something in the notion that forcing the enemy to attack many political entities increases the seriousness of his decision, but there is very little in the notion that dispersal in several countries makes the problem of destruction more difficult in the military sense. Dispersal does not require separation by the distance of oceans—just by the lethal diameters of enemy bombs. And the task of coordinating bomber attacks on Europe and the eastern coast of the United States, say, is not appreciably more difficult than coordinating attacks on our east and west coasts. In the case of ballistic missiles, the elapsed time from firing to impact on the target can be calculated with high accuracy. Although there will be some failures and delays, times of firing can be arranged so that impact on many dispersed points is almost simultaneous—on Okinawa and the United Kingdom, for instance, as well as on California and Ohio. Moreover, it is important to keep in mind that these far-flung bases, while distant from each other and from the United States, are on the whole close to the enemy. To eliminate them, therefore, requires a smaller expenditure of resources on his part than targets at intercontinental range. For close-in targets he can use a wider variety of weapons carrying larger payloads and with higher accuracy.

The seeming appositeness of an overseas-based Thor and Jupiter as an answer to a Russian intercontinental ballistic missile stems not so much from any careful analysis of their retaliatory power under attack as from the directness of the comparison they suggest: a rocket equals a rocket, an intercontinental missile equals an intermediate-range missile based at closer range to the target. But this again mistakes the nature of the technological race. It conceives the problem of deterrence as that of simply matching or exceeding the aggressor's capability to strike first. A surprising proportion of the debate on defense policy has betrayed this confusion. Matching technological developments are useful for prestige, and such demonstrations have a vital function in preserving the alliance and in reassuring the neutral powers. But propaganda is not enough. The only reasonably certain way of maintaining a reputation for strength is to display an actual power to our friends as well as our enemies. We should ask, then, whether further expansion of the current programs for basing Thor and Jupiter is an efficient way to increase American retaliatory power. If overseas bases are considered too vulnerable for manned bombers, will not the same be true for missiles?

The basis for the hopeful impression that they will not is rather vague, including a mixture of hypothetical properties of ballistic missiles in which perhaps the dominant element is their supposedly much more rapid, "push-button" response. What needs to be considered here are the response time of such missiles (including decision, preparation and launch times), and how they are to be defended.

The decision to fire a missile with a thermonuclear warhead is much harder to make than a decision simply to start a manned aircraft on its way, with orders to return to base unless instructed to continue to its assigned target. This is the "fail-safe" procedure practised by the U.S. Air Force. In contrast, once a missile is launched, there is no method or recall or deflection which is not subject to risks of electronic or mechanical failure. Therefore such a deci-

sion must wait for much more unambiguous evidence of enemy intentions. It must and will take a longer time to make and is less likely to be made at all. Where more than one country is involved, the joint decision is harder still, since there is opportunity to disagree about the ambiguity of the evidence, as well as to reach quite different interpretations of national interest. On much less momentous matters the process of making decisions in NATO is complicated, and it should be recognized that such complexity has much to do with the genuine concern of the various NATO powers about the danger of accidentally starting World War III. Such fears will not be diminished with the advent of I.R.B.M.s. In fact, widespread dispersion of nuclear armed missiles raises measurably the possibility of accidental war.

Second, it is quite erroneous to suppose that by contrast with manned bombers the first I.R.B.M.s can be launched almost as simply as pressing a button. Count-down procedures for early missiles are liable to interruption, and the characteristics of the liquid oxygen fuel limits the readiness of their response. Unlike JP–4, the fuel used in jet bombers, liquid oxygen cannot be held for long periods of time in these vehicles. In this respect such missiles will be *less* ready than alert bombers. Third, the smaller warning time available overseas makes more difficult any response. This includes, in particular, any active defense, not only against ballistic missile attacks but, for example, against low altitude or various circuitous attacks by manned aircraft.

Finally, passive defense by means of shelter is more difficult, given the larger bomb yields, better accuracies and larger forces available to the Russians at such close range. And if the press reports are correct, the plans for I.R.B.M. installations do not call for bomb-resistant shelters. If this is so, it should be taken into account in measuring the actual contribution of these installations to the West's retaliatory power. Viewed as a contribution to deterring all-out attack on the United States, the Thor and Jupiter bases seem unlikely to compare favorably with other alternatives. If newspaper references to hard bargaining by some of our future hosts are to be believed, it would seem that such negotiations have been conducted under misapprehensions on both sides as to the benefits to the United States.

But many proponents of the distribution of Thor and Jupiter—and possibly some of our allies—have in mind not an increase in U.S. deterrence but the development of an independent capability in several of the NATO countries to deter all-out attack against themselves. This would be a useful thing if it can be managed at supportable cost and if it does not entail the sacrifice of even more critical measures of protection. But aside from the special problems of joint control, which would affect the certainty of response adversely, precisely who their legal owner is will not affect the retaliatory power of the Thors and Jupiters one way or the other. They would not be able to deter an attack which they could not survive. It is curious that many who question the utility of American overseas bases (for example, our bomber bases in the United Kingdom) simply assume that, for our allies, possession of strategic nuclear weapons is one with deterrence.

There remains the view that the provision of these weapons will broaden the range of response open to our allies. In so far as this view rests on the belief that the intermediate-range ballistic missile is adapted to limited war, it is wide of the mark. The inaccuracy of an I.R.B.M. requires high-yield warheads, and such a combination of inaccuracy and high yield, while quite appropriate and adequate against unprotected targets in a general war, would scarcely come within even the most lax, in fact reckless, definition of limited war. Such a weapon is inappropriate for even the nuclear variety of limited war, and it is totally useless for meeting the wide variety of provocation that is well below the threshold of nuclear response. In so far as these missiles will be costly for our allies to install, operate and support, they are likely to displace a conventional capability that might be genuinely useful in limited engagements. More important, they are likely to be used as an excuse for budget cutting. In this way they will accelerate the general trend toward dependence on all-out response and so will have the opposite effect to the one claimed.

Nevertheless, if the Thor and Jupiter have these defects, might not some future weapon be free of them? Some of these defects, of course, will be overcome in time. Solid fuels or storable liquids will eventually replace liquid oxygen, reliabilities will increase, various forms of mobility or portability will become feasible, accuracies may even be so improved that such weapons can be used in limited wars. But these developments are all years away. In consequence, the

discussion will be advanced if a little more precision is given such terms as "missiles" or "modern" or "advanced weapons." We are not distributing a generic "modern" weapon with all the virtues of flexibility in varying circumstances and of invulnerability in all-out war. But even with advances in the state of the art on our side, it will remain difficult to maintain a deterrent, especially close in under the enemy's guns.

It follows that, though a wider distribution of nuclear weapons may be inevitable, or at any rate likely, and though some countries in addition to the Soviet Union and the United States may even develop an independent deterrent, it is by no means inevitable or even very likely that the power to deter all-out thermonuclear attack will be widespread. This is true even though a minor power would not need to guarantee as large a retaliation as we in order to deter attack on itself. Unfortunately, the minor powers have smaller resources as well as poorer strategic locations.[9] Mere membership in the nuclear club might carry with it prestige, as the applicants and nominees expect, but it will be rather expensive, and in time it will be clear that it does not necessarily confer any of the expected privileges enjoyed by the two charter members. The burden of deterring a general war as distinct from limited wars is still likely to be on the United States and therefore, so far as our allies are concerned, on the military alliance.

There is one final consideration. Missiles placed near the enemy, even if they could not retaliate, would have a potent capability for striking first by surprise. And it might not be easy for the enemy to discern their purpose. The existence of such a force might be a considerable provocation and in fact a dangerous one in the sense that it would place a great burden on our deterrent force which more than ever would have to guarantee extreme risks to the attacker—worse than the risks of waiting in the face of this danger. When not coupled with the ability to strike in retaliation, such a capability might suggest—erroneously, to be sure, in the case of the democracies—an intention to strike first. If so, it would tend to provoke rather than to deter general war.

I have dealt here with only one of the functions of overseas bases: their use as a support for the strategic deterrent force. They have a variety of important military, political, and economic rôles which are beyond the scope of this paper. Expenditures in connection with the construction or operation of our bases, for example, are a form of economic aid and, moreover, a form that is rather palatable to the Congress. There are other functions in a central war where their importance may be very considerable and their usefulness in a limited war might be substantial.

Indeed nothing said here should suggest that deterrence is in itself an adequate strategy. The complementary requirements of a sufficient military policy cannot be discussed in detail here. Certainly they include a more serious de-

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[9] General Gallois argues that, while alliances will offer no guarantee, "a small number of bombs and a small number of carriers suffice for a threatened power to protect itself against atomic destruction." (*Réalités, op. cit.*, p. 71.) His numerical illustrations give the defender some 400 underground launching sites (*ibid.*, p. 22, and *The Reporter, op. cit.*, p. 25) and suggest that their elimination would require between 5,000 and 25,000 missiles—which is "more or less impossible"—and that in any case the aggressor would not survive the fallout from his own weapons. Whether these are large numbers of targets from the standpoint of the aggressor will depend on the accuracy, yield and reliability of offense weapons as well as the resistance of the defender's shelters and a number of other matters not specified in the argument. General Gallois is aware that the expectation of survival depends on distance even in the ballistic missile age and that our allies are not so fortunate in this respect. Close-in missiles have better bomb yields and accuracies. Moreover, manned aircraft—with still better yields and accuracies—can be used by an aggressor here since warning of their approach is very short. Suffice it to say that the numerical advantage General Gallois cites is greatly exaggerated. Furthermore, he exaggerates the destructiveness of the retaliatory blow against the aggressor's cities by the remnants of the defender's missile force—even assuming the aggressor would take no special measures to protect his cities. But particularly for the aggressor—who does not lack warning—a civil defense program can moderate the damage done by a poorly organized attack. Finally, the suggestion that the aggressor would not survive the fall-out from his own weapons is simply in error. The rapid-decay fission products which are the major lethal problem in the locality of a surface burst are not a serious difficulty for the aggressor. The amount of the slow-decay products, strontium-90 and cesium-137, in the atmosphere would rise considerably. If nothing were done to counter it, this might, for example, increase by many times the incidence of such relatively rare diseases as bone cancer and leukemia. However, such a calamity, implying an increase of, say, 20,000 deaths per year for a nation of 200,000,000, is of an entirely different order from the catastrophe involving tens of millions of deaths, which General Gallois contemplates elsewhere. And there are measures that might reduce even this effect drastically. (See the RAND Corporation Report R-322-RC, *Report on a Study of Non-Military Defense*, July 1, 1958.)

velopment of power to meet limited aggression, especially with more advanced conventional weapons than those now available. They also include more energetic provision for active and passive defenses to limit the dimensions of the catastrophe in case deterrence should fail. For example, an economically feasible shelter program might make the difference between 50,000,000 survivors and 120,000,000 survivors.

But it would be a fatal mistake to suppose that because strategic deterrence is inadequate by itself it can be dispensed with. Deterrence is not dispensable. If the picture of the world I have drawn is rather bleak, it could none the less be cataclysmically worse. Suppose both the United States and the Soviet Union had the power to destroy each other's retaliatory forces and society, given the opportunity to administer the opening blow. The situation would then be something like the old-fashioned Western gun duel. It would be extraordinarily risky for one side *not* to attempt to destroy the other, or to delay doing so, since it not only can emerge unscathed by striking first but this is the sole way it can reasonably hope to emerge at all. Evidently such a situation is extremely unstable. On the other hand, if it is clear that the aggressor too will suffer catastrophic damage in the event of his aggression, he then has strong reason not to attack, even though he can administer great damage. A protected retaliatory capability has a stabilizing influence not only in deterring rational attack, but also in offering every inducement to both powers to reduce the chance of accidental war.

The critics who feel that deterrence is "bankrupt" sometimes say that we stress deterrence too much. I believe this is quite wrong if it means that we are devoting too much effort to protect our power to retaliate; but I think it is quite right if it means that we have talked too much of a strategic threat as a substitute for many things it cannot replace.

VI. DETERRENCE, ACCIDENTS AND DISARMAMENT

Up to now I have talked mainly about the problem of deterring general war, of making it improbable that an act of war will be undertaken deliberately, with a clear understanding of the consequences, that is, rationally. That such deterrence will not be easy to maintain in the 1960s simply expresses the proposition that a surprise thermonuclear attack might *not* be an irrational or insane act on the part of the aggressor. A deterrent strategy is aimed at a rational enemy. Without a deterrent, general war is likely. With it, however, war might still occur.

In order to reduce the risk of a rational act of aggression, we are being forced to undertake measures (increased alertness, dispersal, mobility) which, to a significant extent, increase the risk of an irrational or uintentional act of war. The accident problem is serious, and it would be a great mistake to dismiss the recent Soviet charges on this subject as simply part of the war of nerves. In a clear sense the great multiplication and spread of nuclear arms throughout the world, the drastic increase in the degree of readiness of these weapons, and the decrease in the time available for decision on their use must inevitably raise the risk of accident. The B–47 accidents this year at Sidi Slimane and at Florence, S.C., and the recent Nike explosion are just a beginning. Though incidents of this sort are not themselves likely to trigger misunderstanding, they suggest the nature of the problem.

There are many sorts of accidents that could happen. There can be electronic or mechanical failures of the sort illustrated by the B–47 and Nike mishaps; there can be aberrations of individuals, perhaps quite low in the echelon of command; there can be miscalculations on the part of governments as to enemy intent and the meaning of ambiguous signals. Not all deterrent strategies will involve the risk of accident equally. One of the principles of selecting a strategy should be to reduce the chance of accident wherever we can, without a corresponding increase in vulnerability to a rational surprise attack. This is the purpose of the "fail-safe" procedures for launching SAC.

These problems are also relevant to the disarmament question. The Russians, exploiting an inaccurate United Press report which suggested that SAC started en masse toward Russia in response to frequent radar "ghosts," cried out against these supposed Arctic flights. The U.S. response, and its sequels, stated correctly that such flights had never been undertaken except in planned exercises and would not be undertaken in response to such unreliable warning. We pointed out the importance of quick response and a high degree of readiness in the pro-

tection of the deterrent force. The nature of the fail-safe precaution was also described.

We added, however, to cap the argument, that if the Russians were really worried about surprise attack they would accept the President's "open skies" proposal. This addition, however, conceals an absurdity. Aerial photography would have its uses in a disarmament plan—for example, to check an exchange of information on the location of ground bases. However, so far as surprise is concerned, an "open skies" plan would have direct use only to discover attacks requiring much more lengthy, visible, and unambiguous preparations than are likely today.[10] The very readiness of our own strategic force suggests a state of technology which outmodes the "open skies" plan as a counter to surprise attack. Not even the most advanced reconnaissance equipment can disclose an intention from 40,000 feet. Who can say what the men in the blockhouse of an ICBM base have in mind? Or, for that matter, what is the final destination of training flights or fail-safe flights starting over the Pacific or North Atlantic from staging areas?

The actions that need to be taken on our own to deter attack might usefully be complemented by bilateral agreements for inspection and reporting and, possibly, limitation of arms and of methods of operating strategic and naval air forces. But the protection of our retaliatory power remains essential; and the better the protection, the smaller the burden placed on the agreement to limit arms and modes of operation and to make them subject to inspection. Reliance on "open skies" alone to prevent surprise would invite catastrophe and the loss of power to retaliate. Such a plan is worthless for discovering a well prepared attack with ICBMs or submarine-launched missiles or a routine mass training flight whose destination could be kept ambiguous. A tremendous weight of weapons could be delivered in spite of it.

Although it is quite hopeless to look for an inspection scheme which would permit abandonment of the deterrent, this does not mean that some partial agreement on inspection and limitation might not help to reduce the chance of any sizable surprise attack. We should explore the possibilities of agreements involving limitation and inspection. But how we go about this will be conditioned by our appreciation of the problem of deterrence itself.

The critics of current policy who perceive the inadequacy of the strategy of deterrence are prominent among those urging disarmament negotiations, an end to the arms race and a reduction of tension. This is a paramount interest of some of our allies. The balance of terror theory is the basis for some of the more lighthearted suggestions: if deterrence is automatic, strategic weapons on one side cancel those of the other, and it should be easy for both sides to give them up. So James E. King, Jr., one of the most sensible writers on the subject of limited war, suggests that weapons needed for "unlimited" war are those which both sides can most easily agree to abolish, simply because "neither side can anticipate anything but disaster" from their use. "Isn't there enough stability in the 'balance of terror,'" he asks, "to justify our believing that the Russians can be trusted—within acceptable limits—to abandon the weapons whose 'ultiity is confined to the threat or conduct of a war of annihilation'?"[11]

Indeed, if there were no real danger of a rational attack, then accidents and the "*n*th" country problem would be the only problems. As I have indicated, they are serious problems and some sorts of limitation and inspection agreement might diminish them. But if there is to be any prospect of realistic and useful agreement, we must reject the theory of automatic deterrence. And we must bear in mind that the more extensive a disarmament agreement is, the smaller the force that a violator would have to hide in order to achieve complete domination. Most obviously, "*the abolition* of the weapons necessary in a general or 'unlimited' war" would offer the most insuperable obstacles to an inspection plan, since the violator could gain an overwhelming advantage from the concealment of even a few weapons. The need for a deterrent, in this connection too, is ineradicable.

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[10] Aerial reconnaissance, of course, could have an *indirect* utility here for surveying large areas to determine the number and location of observation posts needed to provide more timely warning.

[11] James E. King, Jr., "Arms and Man in the Nuclear-Rocket Era," The New Republic, Sept. 1, 1958.

VII. SUMMARY

Almost everyone seems concerned with the need to relax tension. However, relaxation of tension, which everyone thinks is good, is not easily distinguished from relaxing one's guard, which almost everyone thinks is bad. Relaxation, like Miltown, is not an end in itself. Not all danger comes from tension. To be tense where there is danger is only rational.

What can we say then, in sum, on the balance of terror theory of automatic deterrence? It is a contribution to the rhetoric rather than the logic of war in the thermonuclear age. The notion that a carefully planned surprise attack can be checkmated almost effortlessly, that, in short, we may resume our deep pre-sputnik sleep, is wrong and its nearly universal acceptance is terribly dangerous. Though deterrence is not enough in itself, it is vital. There are two principal points.

First, deterring general war in both the early and late 1960s will be hard at best, and hardest both for ourselves and our allies wherever we use forces based near the enemy.

Second, even if we can deter general war by a strenuous and continuing effort, this will by no means be the whole of a military, much less a foreign policy. Such a policy would not of itself remove the danger of accidental outbreak or limit the damage in case deterrence failed; nor would it be at all adequate for crises on the periphery.

A generally useful way of concluding a grim argument of this kind would be to affirm that we have the resources, intelligence, and courage to make the correct decisions. That is, of course, the case. And there is a good chance that we will do so. But perhaps, as a small aid toward making such decisions more likely, we should contemplate the possibility that they may *not* be made. They *are* hard, *do* involve sacrifice, *are* affected by great uncertainties and concern matters in which much is altogether unknown and much else must be hedged by secrecy; and, above all, they entail a new image of ourselves in a world of persistent danger. It is by no means *certain* that we shall meet the test.

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ADMINISTRATION OF THE NATIONAL SECURITY PROGRAM

By James A. Perkins, vice president, Carnegie Corporation

[NOTE: This paper was presented at the session on "Organization for National Security" at the annual conference of the American Society for Public Administration, March 7, 1953.]

The National Security Act of 1947 provides the organizational structure in the executive branch for managing our program of national security. This act was amended in 1949 to correct some deficiencies, but the agencies of today are essentially those established in 1947. Before attempting an analysis of the present working of our security structure, let us make a quick review of the cast of characters and the roles they were and are expected to play.

I

The legislation of 1947 was designed to correct the deficiences in our World War II machinery. These deficiencies were four in number.

The first was the absence of adequate machinery for providing satisfactory coordination between the armed services. War experience had demonstrated the need for field commanders who had jurisdiction over both Army and Navy units operating in their theaters. Centralized field management led inevitably to the demand for centralized headquarters management. A complementary pressure arose out of our dealings with the British. When the Combined Chiefs of Staff was organized the service members on our side of the table did not speak with one voice while our British opposite numbers did. This situation led to the formation of the United States Joint Chiefs of Staff, and it was generally agreed that some such unified arrangement would have to continue after the war.

The second failing in our World War II management was the absence of proper coordination between diplomatic and military matters or, to put it in terms of institutions, adequate coordination between the State Department

and the two military departments. The need for this coordination led to the State-War-Navy Coordinating Committee established toward the end of the war, but as John J. McCloy recently pointed out in his Godkin lectures,[13] SWNCC was a very imperfect instrument infrequently used. We had come to understand that political and diplomatic considerations were inextricably entangled with military strategy, and it was felt that administrative machinery should reflect this central fact.

The third consideration was the need for rationalizing our overseas intelligence operations. Anyone who was in Europe in the spring and summer of 1945 was well aware that our overseas intelligence operations had gotten out of hand. An Army major in Ludwigshafen once complained to me that he had had to deal with thirteen different intelligence teams within a period of three weeks. In addition to this multiplicity of intelligence outfits, there was the growing realization that the nature of modern warfare requires intelligence on a broad spectrum of matters ranging from troops and supplies to factory location and design and the state of mind and health of peoples all over the globe. Thus, there was need both for a centralization of our intelligence operations and for an organization that could employ and exploit a wide variety of special talents.

The fourth lesson was the need for better planning of our domestic economic mobilization. The work that had been done, largely under military auspices, prior to World War II was hardly even studied, let alone used as a basis for actual mobilization activities. It was believed that this responsibility should be given to a civilian agency which would be kept in close touch with those concerned with political and strategic planning.

The need for mobilization staff work was met by the establishment of the National Security Resources Board. The rationalization of our intelligence operations was taken care of by the formation of the Central Intelligence Agency. The unification of the services and the maintenance of civilian control was provided for by the formation of the Department of Defense and the legal establishment of the Joint Chiefs of Staff. And the coordination of all these activities within the general framework of national security planning was institutionalized in the National Security Council.

Two other instrumentalities must be mentioned as part of the general machinery for national security planning and operations. The United Nations was the agency through which we would adjust our conflicts of interest with the Soviet Union. The assumption that such conflicts could be resolved was certainly a cornerstone of our immediate postwar security policy and the UN was the chosen instrument. We must also mention the Atomic Energy Commission as having a key part in this play, even though its role in security planning was but dimly understood when that agency was created. It is worthy of note that the UN and the AEC, representing respectively the instrument for negotiating with the Soviet Union and the chief instrument for restraining the Soviet Union, were both far removed from the council tables where national security policy was being developed.

At the outbreak of the Korean War in July, 1950, the machinery had been in operation exactly three years. In large measure it had failed to perform the functions for which it was established. It had not provided the necessary guidance for our program in Germany. It had not anticipated or successfully dealt with the explosive problems in the Middle East and Far East. It had not been able to produce adequate plans for equating our military strength with our growing commitments. The Korean War caught us unprepared in terms both of policy and of military potential. We had shown considerable capacity for reacting to demonstrated dangers. The Berlin Airlift, the Truman Doctrine for Greece and Turkey, the Marshall Plan, and the mobilization of the UN to deal with the Korean crisis are the most notable examples. I suspect, however, that careful case studies of these events will tell a story of improvisation rather than planning—of policy formed after the fact and commitments continually outrunning domestic arrangements.

The net effect of the Korean War was to bring about a restatement of our security policy in line with our actions of the preceding three years. The security organization began to function first by codifying the doctrine of containment (largely through State Department leadership) and then by

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[13] Delivered at Harvard University in January, 1953, and to be published by the Harvard University Press.

hammering out programs of foreign aid and remobilization to fit the implications of the doctrine. Much of the muddiness of the pre-Korean days was cleared up under the pressuure of actual warfare, threats of greater dangers, and the happy circumstances of friendly working relations between the heads of the State and Defense Departments and the chairman of the JCS.

II

Now let us turn to an analysis of the existing organization and see if we can identify the main issues that require the attention of those who are concerned with improving the management of our security program. On a subject as vast and complex as this it will be possible to select only a few problems for even the briefest treatment. The problems I have selected are: the organization of the Department of Defense, the contribution of the State Department, the functioning of the National Security Council, and the role of Congress in security planning. Obviously, each of these topics warrants a paper by itself but perhaps we can point up some basic considerations that must be a part of more extended studies.

The Department of Defense almost defies precise administrative analysis, largely because it has within it four different focuses of executive power and each focus of power was established for different reasons. The Chief of Staff of each of the three individual services is the central and dominant instrument for management within the Pentagon. It is under his direction that coordination of logistics, tactics, research, and personnel takes place. The other three sources of managerial power are of a lesser order of importance and serve either as checks or irritants on the service chief, depending on your point of view.

The Joint Chiefs of Staff as an institution is the second source of managerial power. Provided by statute with broad responsibilities for coordinated planning, it has a chairman who has no vote and is largely a presiding officer. It is hard to tell how far the JCS represents anything more than the sum of its parts. Certainly the service members thereon are not continually forced to modify their external operations because of the existence of a collective will they recognize as more powerful and binding than their own internal necessities. It is an essentially unexamined question whether the compromises effected in JCS meetings have advanced or hindered imaginative military planning.

The third power position in the Department of Defense is the civilian Secretary of an individual service. Former Secretary James Forrestal has said that a civilian Secretary is like an ant on a log floating downstream who believes he is a fast swimmer. Certainly the actual authority of a civilian Secretary is a fraction of that exercised by his Chief of Staff. The Secretary may persuade, admonish, and request. But only if he has been on his job a long time and is very wise and very determined will he actually have any measurable influence on the substance of the activity of the military establishment under his control.

The fourth and highest ranking power position is, of course, the Secretary of Defense. On paper he has the widest powers, but as Secretary of Defense Robert A. Lovett has indicated in his *ave atque vale*, there are few real tools at his command for exercising the authority he possesses.

Military planning on a unified basis can only be accomplished by increasing the collective will of the JCS at the expense of the individual service Chiefs of Staff. Neither unified planning nor unified headquarters management can be provided unless the position of the chairman and membership is reformulated. Unification cannot take place through the efforts of the civilian Secretaries no matter how much paper power is devolved on them. The key to real unification rests on provisions for the Joint Chiefs and nowhere else.

Early considerations of a chairman of the Joint Chiefs with power to override his colleagues on matters affecting unified planning were dismissed because of fears of creating too powerful a military figure. I would question whether this danger has been properly weighed on the scale with the advantages of unified planning. My vote would go to giving the chairman an overriding veto on all service proposals that are contrary to the dictates of unified planning and the equally important power of bringing positive proposals for unified activity before the JCS with power of appeal to the Secretary of Defense if they are not accepted. The Joint Staff of the JCS would have to be placed under his control with powers of fitness ratings within his sole jurisdiction.

While strengthening the position of the chairman of the JCS is the pivot for progressive unification, there remains the problem of the current work load of

the JCS which acts as a major barrier to effective planning. Unified planning involves both effective leadership and time.

It has been suggested that both unified leadership and time for planning can be accomplished if the JCS is divorced from command responsibilities. This is the thesis in a brilliant speech given by Dr. Vannevar Bush at Rochester, New York, and repeated at Tufts College. With some modifications it was the gist of Mr. Lovett's parting letter to the President.

The problem of the work load of the JCS is indeed a critical one, but I must confess to considerable uneasiness with the Bush-Lovett therapy. Planning that does not involve the constant participation of those responsible for carrying out the plans is a formula with built-in hazards. Planning soon takes on an academic tone and the operators ignore the plans. Then who sees to it that the plans are enforced or carried out?

At this point Bush and Lovett suggest a quite radical rearrangement of lines of authority. Once the JCS is established as an advisory body, the line of command would run from the President to the Secretary of Defense to the Secretary of a department to the appropriate service chief. The pattern is logical, but it presents two major difficulties that, in my judgment, undermine the whole scheme.

First, it puts impermanent and possibly inexperienced civilian officials into the middle of the military machinery. I cannot believe that the civilians would be anything else than disrupting factors in such a scheme. Second, since the newly constructed JCS would have to have constant contact with the operating heads of the military establishments, would there not be developed a second chain of command for the JCS to the service chiefs? The necessity for close contact between planning and operations would require such a close working relationship. But two lines of authority surely breed disaster.

My own prescription for the work load problem runs along less drastic lines. The chairman should apply more rigid control of the agenda and refuse to allow the JCS to spend time on administrative details. The Chiefs of Staff should delegate far more administrative responsibility to their deputies. But most important of all, the solution of the work load of the JCS rests on vigorous staff work and leadership in security planning from the State Department and the NSC. The JCS has operated like a small NSC. A proper reallocation of planning leadership will go a long way toward resolving the problem of the JCS schedule.

The third type of Pentagon management is found in the three civilian Secretaries of the service departments. The development of the Office of the Secretary of Defense has made the office of the service Secretary more and more a meaningless post. Caught between the Secretary of Defense on top and his service chief below, his *raison d'être* has been progressively attenuated. Clearly the post should be reformulated as an agency of the Defense Secretary so as to provide for the unification of civilian authority. Former Air Secretary Thomas K. Finletter believes that this move would seriously weaken civilian control because a lesser post would attract lesser men. This is an important point but not, in my opinion, decisive.

This leaves the Secretary of Defense or rather the office of the Secretary of Defense as the central position for assuring civilian control, for acting as a court of appeal for the JCS, and for representing the department before the Congress and in the complex of relations with other governmental agencies.

But it is also the office to which the President, the Congress, and the public look to provide for the unification prescribed in the Defense Act of 1947. Absence of unification has continuously led to suggestions for increasing the powers of this office. As I have already mentioned, the key to unification is in the JCS not the Defense Secretary, and the reason is that the Defense Secretary is not really able to exercise the powers that have been given to him already.

He is not able to exercise these powers because of the basic disjunction between the civilian and military officers. The latter are members of a professional group with its own provisions for promotion and assignment and its own systems of rewards and penalties. In short, the authority of the civilian Secretary is more prescribed by his own knowledge and experience than by the powers provided by legislation or executive order.

There is no short cut around sheer know-how for effective civilian control of the military establishments and this know-how must be demonstrated in the councils of the executive arm or before the congressional committees before the military establishment will begin to take seriously the wishes of the civilian

Secretary or his staff. Since this is so, the turnover of Secretaries of Defense (five in six years) has had a greater influence in limiting civilian authority than all the language in the statutes. In this light it can only be viewed as our great good fortune that W. J. McNeil, Frank C. Nash, and Walter S. Whitman[13] have continued over from one administration to the next. This is our greatest guarantee of effective civilian supervision and pressure for unified planning.

III

We shall now turn our attention to the Department of State which is, of course, the key agency for all political and diplomatic considerations in the field of security planning. As a general proposition, the Department of State has adjusted itself far too slowly to the tasks that are inherent in this key role and as a result it has, in general, not played the part of the effective leader in shaping our cold war strategy.

Of course, the central reason for this disability is to be found in the essentially isolationist position that characterized the posture of the U.S. until recent years. World leadership has only recently been thrust upon us, and until one assumes the necessity for leadership one does not face the need for broad planning.

The first new responsibility that the State Department absorbed over and beyond the traditional business of normal day-to-day diplomatic relations with individual countries was in the field of foreign trade. Anyone who has had experience in the department is fully familiar with the organizational convulsions that have taken place in efforts to assimilate this area of consideration into established State Department organization. Be that as it may, by the outbreak of World War II the State Department had effectively taken leadership in the field of the trade agreements in particular and foreign economic policy in general.

The outbreak of World War II brought us face to face with the necessity for plans and operations in a whole variety of fields with which the State Department was almost completely unfamiliar and the net result was that agencies were established outside the department to handle these assignments. The Office of War Information dealt with the broad area of public information abroad, the Board of Economic Warfare with economic warfare, and the Office of Lend-Lease Administration with supplying our Allies with the goods and services they needed to conduct the war. The State Department was able to exercise only a minimum of control and direction over the activities of these agencies, with the result that whatever central management there was came from the White House.

The latter years of the war and the postwar period only increased the number and scope of United States activities abroad and departmental efforts to keep on top of this expanding universe have not been successful enough to assure the leadership that the situation requires.

The Department of State has made a number of important organizational moves in the last six or seven years that will reduce the deficiency. The Policy Planning Staff was organized by General Marshall as a means of providing a place in the department that could concern itself with across-the-board matters. No planning staff is any better than the determination of a Secretary to use it wisely, and it is my impression that the members of the Policy Planning Staff have been used far too often in specific operating cases rather than for the purposes for which the staff was originally designed. Furthermore, the establishment of such a planning unit immediately brings with it the age-old difficulty of a proper marriage with the operating divisions. While no divorce has taken place I would gather that evenings spents around the fireside are at a minimum.

The second problem that must be faced is that planning is becoming more a regional than a country affair. This presents one of the more acute organizational problems for a department that has been organized on a country desk basis. But once again, I gather that the department is slowly making moves to establish divisions with regional as well as individual country specialities.

But it is in the field of military and strategical considerations that the department is still woefully weak. As a general proposition I would say that there are more military officers who have a first-hand knowledge of diplomatic matters than there are State Department people who have an equivalent knowl-

[13] Who hold the positions, respectively, of assistant secretary of defense (comptroller); assistant secretary of defense for international security affairs; and chairman, Research and Development Board.

edge of military affairs. This imbalance has put, and will continue to put, departmental representatives at a tremendous disadvantage in evolving appropriate security strategy. The Department of Defense has recently made Frank Nash an assistant secretary with responsibility for the international aspects of Defense Department business. Is there any reason why the State Department should not have an officer who is concerned with the military aspects of State Department business?

Finally, the State Department will have to develop techniques of remote control. Large-scale military, economic, and informational activities will in all probability be carried on by agencies that are not part of the department but it will be imperative that their operations conform to plans that the department lays out. I would not suggest for a moment that this is a simple process, but I do strongly believe that imagination and vigor can go a long way toward assuring departmental leadership over the many agencies that will be dealing with matters of foreign affairs.

The development by the Department of State of effective planning, particularly on a regional and worldwide basis, an appropriate solution of the relationship of planning to operations, the development of sophistication in the field of military strategy, and the evolution of effective techniques in remote control will go far to redress the imbalance of security planning. These developments would have a most constructive and decisive effect on the very substance of our relations with the rest of the world.

IV

From a discussion of the Defense and State Departments one moves naturally to some comments on the National Security Council. The problem of the NSC is partly one of mechanics and partly one of substance.

The NSC suffers from a statutory definition of membership that has made the consideration of important matters a more complicated process than is necessary. Different problems require the participation of different agencies and the President should feel free to have the membership at the meetings adjusted to the problems. With prescription of membership, the problems are all too frequently adjusted to the membership. This is obviously absurd.

Another organizational failing has been the absence of a presidential agent with sufficient prestige and stature to provide the proper direction to NSC affairs. Leadership of the NSC is a full-time job which the President has, of course, not been able to provide. I understand that President Eisenhower has designated Robert Cutler as his man for NSC affairs. This will, of course, supply an important missing piece.

But the root problems of the NSC are not essentially matters of organization. They are, rather, matters of insufficient experience and expertise, on the one hand, and unwillingness on the part of its membership to have policy determined by such a body, on the other.

The absence of persons trained and widely experienced in the complexities of political-military strategy is the first deficiency. A Secretary of Defense with the fullest possible powers will never be able to impress his will on his military subordinates without years of experience in dealing with the three military establishments. Just so, a Secretary of State or Treasury or Chairman of the Atomic Energy Commission will never be able to construct really sound and imaginative security policies and programs without wide and intimate contact with the various parts of this puzzle.

At the present writing military officers are far better grounded in broad security affairs than are our top civilian officials. Military officers can have their careers planned to include graduate work, staff colleges, embassy assignments, and work with a variety of civilian agencies. No similar provisions exist for the civilian counterpart where pay follows the job he is in rather than the man. Until such time as our civil service embraces a system for the specific assignment and wide training of the personnel required for successful dealing with broad security problems, decision-making will gravitate to the Department of Defense and to the Joint Chiefs where more of this capability exists. The problem of the NSC is the problem of civilian expertise, and neither our academic training nor our governmental arrangements are calculated to produce any effective counterweights to the military capabilities in this field.

The essential disability on the part of civilians dealing with security matters has consequences that go beyond the NSC. It means that security considerations are heavily defined in military terms. But nothing is more essential than a full public realization of our political, economic, and social, as well as our military

affairs. Ten tactical air groups can be effectively neutralized if the bases from which they are to fly are surrounded by hostile populations. It may require a ten percent increase in our fleet to assure access to raw materials that are no longer available because of improvident management of our domestic resources. Ten divisions may be added to our team because we have successfully mediated in a solution of the Egyptian problem. Security is not to be defined in military terms alone, and in a cold war situation it would be disastrous not to have factors over which civilians are responsible kept front and center on the council tables.

But these factors can only be given their deserved attention when those responsible can weigh them in the scales with purely military considerations, and this in turn postulates the kind of experience and expertise in which we are at present deficient. In short, there is more at stake than the NSC—it is our imagination, understanding, and effectiveness in mobilizing world power and world opinion on our side.

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Finally, we shall have to make some comments on the role of Congress and Congressmen in the administration of our security program. In order fully to understand the way in which the legislature influences the administration of any executive program we shall have to unlearn a good deal of our textbook maxims about the separation of powers. Only if we realize the critical and sometimes decisive role that the Congress plays in shaping both the organization and the programs of national security will we understand the most complicating factor in executive planning at any level and on any subject. I should like to submit that students of public administration have generally neglected this highly important determinant of administrative arrangements and administrative action.

The basic difficulty stems from the fact that the real power in both houses is exercised through committees which are organized to deal only with parts of the total security program. This leads to committee consideration, committee decision, or at least committee pressure to effect administrative arrangements on one segment of the organization that may throw larger considerations out of focus. Arrangements for the Marine Corps were blocked by a congressional committee, which in turn brought great pressure for giving this service representation on the JCS. A search for subversives can vitiate the Voice of America which may have a top priority in plans for psychological warfare. Unification may be hindered by long-established contacts with, for example, Navy bureaus whose independence is protected by friends on the Hill. All through the administrative machinery there are organizational arrangements that cannot be touched because of congressional protection and others that are changed or modified because of the heavy interest of a congressional group. In short, efforts to centralize and rationalize security planning run afoul of the dispersion of authority in the Congress. Of course, this is the continuing problem in most executive-congressional relations.

Aside from congressional influence on particular parts of the total operation, one general and pervasive influence must be noted. The more nearly a program can be described in military terms the more likely it is that that program can receive congressional approval. The further a program moves from military definitions the more the individual congressman will feel free to enter into and try to influence its nature and administration. The effect of this imbalance of attention is to put security affairs under a military hat wherever possible. Thus, Congress acts as an additional factor in weakening civilian orientation of our security programs.

A critique like this one always sounds more negative than the facts really warrant. A balanced view would show that organizationally we are in far better shape than at any time in our history to deal effectively with the broad and complex matters of national security policy and planning. Additional encouragement comes from the increasing interest of students of public affairs and public administration in the whole area of security affairs. Courses on military history and military policy are appearing in college catalogs. Excellent books and articles are coming into print that throw new light on these complex problems. The Social Science Research Council and the Council or Foreign Relations have recently begun to concentrate attention on the importance of these problems. Good starts have been made, but the magnitude and importance of the problems warrant our greatest concern in the years ahead.

Executive Session

The subcommittee met at 12:35 p.m., pursuant to call, in Room 3302 of the Senate Office Building, Hon. Henry M. Jackson (chairman of the subcommittee) presiding.

Present: Senator Jackson (presiding).

Staff members present: J. K. Mansfield, staff director; Dorothy Fosdick and Grenville Garside, professional staff members; and Edmund E. Pendleton, minority counsel.

Also present: Charles A. Haskins, senior staff member, National Security Council; Robert Berry, representing Senator Karl E. Mundt; and Walter L. Reynolds, chief clerk and staff director of the Committee on Government Operations.

Senator JACKSON. The subcommittee will be in order.

The subcommittee will now resume in accordance with the procedures worked out by the chairman of this subcommittee and the White House. We are meeting in executive session.

You understood from the directive that you received from me by letter what the guidelines are, Dr. Perkins?

Dr. PERKINS. Indeed I did, Senator, and I also received very specific instructions on this score from members of your staff, who want to make sure I understand them.

Senator JACKSON. Did anyone else speak to you about this?

Dr. PERKINS. Yes, sir; a Mr. Haskins, the gentleman who is here, whom I just met this morning, a senior staff member of the National Security Council, called me on the phone and he asked me if I had seen the guidelines. Do you want me to repeat the conversation?

Senator JACKSON. Will you relate the conversation as best you can?

Dr. PERKINS. Well, my recollection of the conversation runs about like this: He called me to ask if I had seen the guidelines, and I said I had. He then reminded me, which I knew, that my appearance before the National Security Council in connection with the Gaither Committee did not necessarily qualify me as an expert witness on NSC affairs and I was only too happy to agree with him.

He wanted to assure me that the matter here was a matter of considerable sensitivity, that he wanted to make sure that I realized that questions were likely to be asked that would seem to suggest that the only proper answer was one that would be enormously critical.

I read him a list of questions that I had received in a letter from you, and he suggested that the question of relations between Defense and State Departments suggested the absence of adequate coordination.

I told him that I thought that honest men could differ as to whether or not it was adequate or not. When I told him that I would be speaking as a private citizen he agreed with me that I should speak my mind as I saw it as long as I was fully conversant with the security factors involved.

I had the general impression that Mr. Haskins certainly wanted to make sure that I realized that I was speaking in a sensitive area, and that the National Security Council and its operations were sensitive matters and that he and his colleagues in the Security Council were concerned that I be objective and discreet in the handling of any questions.

I think that would be a fair and honest account of that conversation.

Senator JACKSON. And you previously advised him, however, that the chairman of this committee and the staff, as well, had make it clear to you by submitting the exchange of letters between myself and the President, and also the so-called guidelines, and so you had all of that information.

Dr. PERKINS. I did indeed, but he was good enough to send me additional copies of the guidelines, which I received in the mail a couple of days ago. I quite independently received another set of the guidelines from Dr. David Beckler. In what capacity he was sending them to me I am not clear, but I think that he is executive officer of the President's Science Advisory Committee.

So I am well equipped with guidelines, Senator, and if I do anything wrong it is not because of a lack of attention from both the administrative side and the legislative side.

Senator JACKSON. With that, I presume that you are fully informed as to the rules.

Dr. PERKINS. I hope so, and it is no one's fault in this room if I do not answer correctly.

Senator JACKSON. Now, I would like to ask you a few questions in connection with the National Security Council.

I wonder if you could indicate your opinion, Dr. Perkins, as to the effectiveness of the National Security Council as an advisory mechanism to the President, in general?

Dr. PERKINS. My answer will be in general, because that is the way you have posed it.

I would say that it has been at its best when it has to do with matters that come within fairly well established guidelines, both in terms of budget and in terms of established orientation, and it has been at its weakest when matters that are extremely controversial and break into new ground or that require major revisions of policy.

Let me elaborate on that if I may, Senator, but I will proceed any way you wish.

Senator JACKSON. Proceed in your own way.

Dr. PERKINS. That would be my specific answer. I think the reason why this is so is that the Security Council, after all, is made up of both statutory and invited members who are the heads of operating agencies. They are brought together to make sure that work in the different departments is coordinated and, of course, as we all know, the Security Council itself was created in response to some badly felt needs for coordination during World War II.

It was a need for more standard and routine coordination of activities, at the top side of both State and Defense, and, at that time, State, War, and Navy, the so-called SWNCC Committee.

When you get a committee of operators, they have enormous ongoing programs and responsibilities, both in Defense, State, and elsewhere, and they find it very difficult to deal with large innovations of policy or program.

It is the inherent, built-in danger of any committee: it will operate most effectively when basic policy is firmly established. It will not operate effectively to establish new policy.

I think if I were to make a general judgment about the NSC, it is that the President has not received from the normal NSC routine the kind of sharp debate, the clear differences of opinion, the new ideas

that would require major modifications of program. However, I think that he has been well served by a group that has stabilized operations, and stabilized it by seeing to it that all parts of the Government are drawn into the process of policy planning.

Now, this is again a case where you are talking or we are talking about styles of administration, if you will. I think my concern about this would be that currently, as one looks at our national security policy, I am impressed with the need for some fairly major rethinking of some of our lines of policy.

I am afraid that this system, and it has nothing to do with the people in it, is not likely to permit new or substantially new ideas to filter their way up uncompromised and vividly expressed.

In short, it has served the process of interagency agreement well. It has not served the job of creating new policy lines, and for anyone to expect that it would, would seem to me to be an error in organizational judgment.

I am told, and there is some evidence both in print and elsewhere from people who have been in it and out of it, that the President is not getting the fresh point of view through this system which, in my judgment, the rapidly evolving cycle that I described in open hearing would require.

Senator JACKSON. Did you have a chance to read Mr. Lovett's testimony?

Dr. PERKINS. Indeed I did; yes, sir.

Senator JACKSON. In general, do you agree with the pertinent points that he made?

Dr. PERKINS. Indeed I do.

Senator JACKSON. He made specific reference to the growing size of the NSC; that is, the broadening composition of it and the rather large meetings. Do you have any comment on that?

Dr. PERKINS. Yes; I do.

Senator JACKSON. Will you proceed?

Dr. PERKINS. I am told they do vary in size. I am not quite sure what a standard-sized meeting is but from reading the piece by Robert Cutler and Gordon Gray who were in print on this subject, it sounds to me as if a standard meeting must be around 19 or 20 people.

There are meetings where much larger numbers than that are invited, and I am also told there are some meetings where smaller numbers are used, but I would gather that maybe 20 has been about an average.

I would have to go back to the point I just made, Senator, that if you view this as a system of validating policies already agreed upon or minor changes therein, there is a pretty good case for increasing the number of people who sit in on those meetings, who then will come away learning what policy is, and by their presence, presumably taking some responsibility for its execution.

So I think that the more one uses the NSC as a system of interagency coordination and the legitimatizing of decisions already arrived at, the growth in numbers is inevitable, because people left out of it and not at the meetings whose concurrence is required have a prima facie case for attending.

But if we are talking about a body that is going to advise the President, as Mr. Lovett suggested in his testimony, and in a free and open

way discuss substantial changes in policy, then I think the larger the number the less effective it is likely to be. In a room full of 20 or 30 people, and sometimes more, many ideas are going to be held back.

Senator JACKSON. In this connection, I quote from the previous testimony of Mr. Lovett on February 23, including my question to him:

Senator JACKSON. Now to turn to this question of the jurisdiction of the NSC: Do you think that it should confine itself to a few important issues as opposed to having a lot of issues brought in?

Mr. LOVETT. Yes, sir; I do; I think the fewer the better.

Dr. PERKINS. I agree, but I think my answer turns on the point I just made. If you are talking about the need of a system for acquiring Government concurrence, then I think that you will bring up more issues.

If you are thinking of a very top-level group of the President's most intimate advisers and those dealing operationally with the most vital parts of national security policy, then I think that you reduce the number of topics.

Senator JACKSON. If I may summarize this general area that we have been covering here in the colloquy, I take it that you feel that the size of the body should be limited in the NSC, and that the issues should be limited to the critical or crucial ones; and lastly, that these critical and crucial issues should be thoroughly discussed and debated with the sharp alternatives presented that naturally follow from that kind of discussion, so that the President can make a decision based on those sharp issues and alternatives.

Dr. PERKINS. I agree with that.

Senator JACKSON. In this way, he discharges fully and completely his constitutional responsibilities, does he not?

Dr. PERKINS. Yes. I want to make awfully sure I am understood about this, Senator, because it is a very delicate and central point in the top-side management of the Government.

You started out your question by asking, "Does this serve well in its advisory function to the President?" If one follows that line, one talks about a small group dealing with large subjects, and relatively few of them, in an atmosphere where there is the widest possible debate made possible, and where the issues are sharpened, and where there is an actual premium put on people coming in and vigorously presenting fresh points of view.

It has been used largely for a second, and in my judgment, somewhat contradictory purpose. It has been used as a system of legitimatizing decisions already arrived at throughout the complex structure of the executive branch.

On that line, you invite more people, and you have more papers, and you have larger numbers of questions. But to the extent that you mix these two functions up, you cannot get good advice from an organization that has been asked to do function No. 2. Nor do you get good implementation, obviously, from a relatively small number who are set up for the advisory purpose.

Do I make myself clear?

Senator JACKSON. I understand fully, and in your comments you are approaching the NSC from the point of philosophy that the body might be better treated as an advisory body to the President.

Dr. PERKINS. That is correct.

Senator JACKSON. In order that he can better fulfill his constitutional responsibilities.

Dr. PERKINS. Precisely.

Senator JACKSON. Obviously, if the President is to use such a body, it must, under the Constitution, be limited to an advisory purpose. The secondary purpose that you mentioned is an entirely different one, and a body to serve that purpose is not an advisory body to the President of the United States.

Dr. PERKINS. I would take it that any student of administration would concur that one of the dangers of an advisory committee is that the person who uses it for advisory purposes can very easily permit that advisory body to turn operational.

This is not just the NSC, but this is applied to General Motors or Harvard University, or any large organization you want to mention. Once the thing turns operational, then the structure slowly changes, and the procedure slowly changes, and the man who originally sets it up begins to withdraw himself from the operation, and permits the machinery itself to settle problems that heretofore he resolved.

Senator JACKSON. Now, I have one last question, Dr. Perkins.

I should like to refer you to our Senate committee print entitled "Organizing for National Security: Selected Materials," and to the article by Mr. Robert R. Bowie called "Analysis of Our Policy Machine." Mr. Bowie, I believe, is currently the director for the center for international affairs at Harvard University.

He was the director of the State Department's policy-planning staff from 1953 to 1957, and in that capacity he served as Assistant Secretary of State.

Have you had an opportunity to read the article?

Dr. PERKINS. Yes; I have. I have had plenty of occasions to talk with Robert Bowie about this, too.

Senator JACKSON. That is over a period of years?

Dr. PERKINS. I have known him a good many years, ever since we were in a command car in Germany together, Senator.

Senator JACKSON. On pages 105 and 106, Mr. Bowie makes four points. I wonder if the points that he makes there, Dr. Perkins, might be applicable in your judgment to the operation of the National Security Council?

Mr. PENDLETON. Let's go over them, and apply them one by one.

Senator JACKSON. Suppose that I just read the points. I think that that might be easier. Mr. Bowie writes as follows:

> In appraising our foreign policy machinery, one can well recall how little time our Nation has had to master its curent role. We emerged from World War II with ill-defined or mistaken notions about our position and our interests, and the threats to them, and about the direction of foreign policy.
>
> Most great powers have had an extended period to develop understanding and techniques of foreign affairs and the framework of policy. Our Nation has had little more than a decade, in times of unprecedented change and turmoil. In evolving its policy and its relations with others it has learned from experience at a rapid rate. In these terms we can be proud of a notable achievement.
>
> We cannot, however, rest on those laurels. History awards no prizes for effort, no matter how creditable, if the results are not adequate to the need. We must, therefore, ask ourselves whether our present procedures are equal to our task. Judged by this criterion, our machinery suffers from several weaknesses.
>
> (1) It is obviously ponderous. In running the gamut of the Federal bureauracy, Congress and its committees and our allies, an analysis or proposal

is likely to be much watered down or blurred by compromise. Moreover, the time and energy required by the process doubtless create strong inertia against initiating new policies or actions or changing existing positions.

In a recent press conference, Secretary Dulles, in explaining why no change was then planned in Western disarmament proposals, said:

"It was not easy to arrive at the present disarmament proposals, representing an agreement, as they did, among 15 countries. Many of these countries had different viewpoints, different interests, and different concerns. It was a task of very great difficulty to bring about agreement, and that agreement is a delicate and fragile one.

"There are aspects of those proposals that were not very happily received by some that went along in the interests of achieving unanimity. Now, to break that unanimity and try to find new unanimity or new proposals without any knowledge in advance as to whether that would be acceptable or not to the Soviet Union would seem to me to be a futile and indeed reckless effort to make."

One need not take issue with this specific decision to realize that the same factors may inhibit revision of policies when conditions change.

What is your reaction to that?

Dr. PERKINS. I would like to associate myself with Robert Bowie on this point. He is covering a variety of matters other than the Security Council, since this comment is addressed to the whole of the Federal bureaucracy, Congress, and his committees, and allies. But since obviously he is including all, he is including the part, and one of them he obviously must have meant was the Security Council.

One does have a feeling that the procedure here is ponderous, and as I think I mentioned earlier, there does seem to be a strong inertia against initiating new policies through this procedure. I think it is because of this inherent contradiction in using the same group for advisory purposes and for operational coordination.

I think if they could get these two functions untangled and leave the NSC to where it was supposed to be in the beginning, as a group who would coordinate their advice to the President in his presence, and sharpen up issues, the ponderousness, if there is such a word, would decrease.

So I think Bowie, who must know, and he was in the middle of this, as director of the policy planning staff in the State Department, has a point.

Senator JACKSON. Mr. Bowie's second point is this:

(2) The machinery has not always assured a realistic appraisal of conditions which run counter to strong preconceptions. The tendency of some to discount persuasive evidence of Soviet economic progress and Soviet ability to produce complex weapons probably resulted in part from reluctance to believe a system so repugnant in its methods could succeed as well as it has. Again, the full sweep of the Soviet threat has been hard for some to grasp because its purposes and methods are so foreign to our own experience. Similarly, seeing the world through the eyes of others with utterly different history, values, and position is especially hard. Yet failure to do so leads inevitably to misjudging reactions in areas like the Middle East.

Dr. PERKINS. I think this is a very important point and it would be pretty hard to separate human nature, Senator, from the NSC itself. Both are involved here.

Let me refer, if I may, and I am free to do so, to the atmosphere that we all discovered when we came down in June or July of 1957, with the Gaither Committee. There it seemed to us quite clear that the nature of the threat was not fully realized, or at least the threat as we discovered it on briefings from the Pentagon and the Central Intelligence Agency.

Mr. PENDLETON. May I interrupt here? If these are planned to be released, I think the Gaither Committee report still has not been released by the President. This would probably have to be deleted.

Senator JACKSON. That is right, but he is just stating his personal judgment. The fact that any matter is taken up in executive session does not make it automatically releasable. It is in accordance with the guidelines and that is why we are in executive session.

Dr. PERKINS. I had no intention of even talking about what was in the Gaither Committee report. I am saying, however, that when we first came down, it seemed to us that the nature of the threat was not fully determined or fully considered. I think that is eminently clear from the country's reaction once sputnik went up.

As a matter of fact, I said then and I say again that whatever words of wisdom we may have put into that document would have largely been wasted if the Russians had not so fully cooperated by sending up a missile one week before we submitted our report, or a satellite, and another one some weeks afterwards. We were well bracketed.

But the point needs to be made that the existing machinery did not seem to bring to the surface in the right way the changed circumstances of the Russian threat to American systems.

Some pieces of this puzzle were known, but you know you can know the parts, but they do not have the full impact on you if you do not pray over them and look at them in a fresh way.

People who are operating enormously large and responsible jobs find it very difficult to rethink their premise every Tuesday. You cannot change your mind about basic things too often or the machinery you are running breaks down.

But I would say in the balance here between the system that sees to it that you operate with some degree of stability on the one hand, and a system that sees to it that the major premises are reexamined in the light of new facts, there is good external evidence, and it has nothing to do with my being on the Gaither Committee, that the Government did not have its eyes open in the summer and fall of 1957.

We did not make the basic reexaminations that should have been made. This is partly human nature because none of us like to reexamine too frequently or too profoundly things we take for granted in our own lives, and this certainly is true about people whether they are private citizens or members of the NSC.

That is why I think Mr. Bowie quite rightly says that the machinery has not always assured a realistic appraisal of conditions which run counter to strong preconceptions.

I would say we are not currently organized to see to it that conditions that run counter to strong preconceptions are kicked to the top and put on the top of the agenda.

Senator JACKSON. Just to clarify an earlier colloquy, when the Gaither Committee was mentioned, I think my reply to a question from Mr. Pendleton might suggest that any reference to the Gaither Committee would be deleted. I think that under the guidelines we have worked out, we adhere to the principles laid down in the guidelines which, of course, forbid any reference to the substantive contents of the Gaither report.

That was covered by a letter of the President to Senator Johnson which I referred to in my earlier opening statement, but the only items

that will be excised will be ones bearing on national security under the rules that apply, that is, the rules of security, and the specific provisions covered by the guidelines.

I just wanted to make clear that just the mere mention or reference to the Gaither Committee is not in itself a security matter. That is just to clarify the record.

Dr. PERKINS. The fact is, the report has not been released and presumably this is not a procedure for detouring around that decision, and none of us want any part in any such detour.

Senator JACKSON. We are not going to do it directly or indirectly, and the President has a constitutional right to have such communications treated as confidential, and otherwise he cannot do his job.

Dr. PERKINS. Of course he does.

Senator JACKSON. There is a real, valid reason for the constitutional principle.

Dr. PERKINS. I might say, those of us on the Gaither Committee have become reasonably expert in dodging efforts to pry out of us what was in that report.

Senator JACKSON. Now, if we may take up Mr. Bowie's points (3) and (4) together, if there is no objection.

Points (3) and (4) read as follows:

(3) The machinery has not produced a balanced allocation of resources among essential activities. The Soviet challenge is many sided. It is not merely a military threat but also a political, diplomatic, and propaganda offensive throughout the world. The most obvious of these threats, however, is the military. Since it is easy to dramatize, there has been a dangerous tendency to emphasize military programs at the expense of other programs in allocating resources.

The programs for economic and technical assistance and for reciprocal trade agreements have had much harder sledding: their results are more gradual and the threat is less dramatic. Yet failure to carry on a balanced program with necessary stress on nonmilitary measures will expose us to grave danger of being slowly strangled and isolated even while maintaining an adequate military posture.

Even the military field suffers from similar distorting factors. The capability for all-out retaliatory capacity, represented by SAC, enjoys widespread support. Yet that capability, while essential, is clearly not enough. The growing Soviet nuclear capacity has tended to erode the value of SAC as a deterrent to local aggression. To stop that hole in its defenses, the United States needs to create and maintain an adequate capacity for using force on a limited scale. Yet neither the Executive nor Congress has fully faced up to this need. Since lack of flexible military means could hamper our diplomacy and imperil our security, this defect could be extremely serious.

(4) The Soviet offensive is essentially long term. The Soviet leaders view "competitive coexistence" as a struggle for an indefinite time. Even if peace is preserved they clearly intend to probe for weak spots and to exploit them fully by all other means. Our programs must also be planned and carried out on a long-term basis.

For various reasons, our machinery is not well suited to planning and action in these terms. In the executive branch day-to-day crises constantly demand immediate action and divert attention from analysis of more basic problems. The annual budget procedure also tends to shorten the focus within which programs are presented and judged.

Again, with elections to Congress every 2 years, Members on the lookout for issues are likely to stress the short run. Finally, the press has a similar bias: the dramatic crisis is newsworthy; the gradual success seldom makes the headlines. All these factors tend to foreshorten the perspective in which programs are judged.

Now, would you comment on Mr. Bowie's point 3?

Dr. PERKINS. This is a judgment that one has to make, and Mr. Bowie has properly made it, as to the totality of our security program or our national security program. It has to do with a judgment about balance among the requirements for deterrence, limited war, civil defense, military assistance, foreign aid to various countries, that in his judgment apparently he feels that this system is out of balance.

I do, too. I think it is out of balance because with the understandable pressure to close this missile gap, too little attention has been given to the nonmilitary components of a total defense posture.

In short, we might find that we have an absolutely invulnerable deterrent, and we might even find that we have an airlift system that meets our limited war requirements to the best possible reasonable measure. But then we could discover that the Soviets' real thrust was in the field of ideology and economics. If we have starved our information office, or have not appropriated enough funds for military assistance, we might be in the position of having locked the front door very well only to discover we had not even put up the screens in the back.

Now, insofar as this is true, and I am inclined to agree with Mr. Bowie that it is true, the place where our original machinery would be responsible is in giving undue weight to the military presentations when one is rounding out a balance between the factors I have just described.

I think this comes back to the fact that we mentioned in open testimony, that the civilians as bargainers in this complex thing called national security policy are not as well or as broadly prepared as their military counterparts.

The civilian in the Pentagon or the civilian in the State Department frequently does not have the full range of briefings, of training, and expertise as his military opposite number. Second, he does not have the enormous advantage of what seems to be the more present danger.

Senator JACKSON. Now, Mr. Bowie's fourth point that the Soviet offensive is essentially long term.

Dr. PERKINS. Yes. On this one, this is an enormously complex matter and gets us into the matter of legislation and budgetary procedure. Also, it goes back to my familiar theme of the NSC becoming operational.

Insofar as the NSC is operational, it is dealing with matters that the operators currently have on their minds. Operators do not have long-term issues on their minds, because they are burdened with matters that they have to solve today. Then they take up tomorrow's problems when tomorrow comes.

So insofar as the NSC has become operational forward planning is likely to be foreshortened. Insofar as the NSC is advisory, its time consideration will be lengthened, and so I am back to my original thinking.

Now, the budgetary process reinforces the operational bias I have just described, because one is hardly through with a budget in this business before you have to deal with the next one.

I am told that most budgetary processes now, in Government departments, involve working with three budgets simultaneously, deficiencies in the past one, the one you are working on, and the one that

is coming up, and all of them involve hearings and operations that involve our operating officials.

This means that when you are dealing with an annual appropriation, from a lower House that has a 2-year life, this very process restricts the range of possible planning, unless one goes in for a variety of devices that can lengthen this out.

So I would say that one of the places where American administrative ingenuity can be most profitably exercised would be evolving a system that has 5- and 10-year leadtimes, that permits planning projections that do not get chewed to bits by annual budgetary cycles.

In short, I think the budgetary process supports a tendency on the part of operators to think in terms of daily crises. To that extent, I would agree with Bowie, that the budgetary business has interferred with long-range planning.

Senator JACKSON. May I just at that point read this brief statement from Mr. Lovett's testimony before this committee on February 23, regarding a longer budget system, and I quote:

> I think that in any experimental development program involving research and the awkward period during translation of research into an actual item, funding it for 1 year is unrealistic. I think we need to have something longer in order not to have to reset sights and suffer the vacillation which ensues.
>
> One of the most painful things that an executive goes through in the Government departments is the change of program while you are right in the middle of it. You lose momentum and you delay the output. So I would say we need some form of budgeting for certainly half of the period of gestation of any new weapon, which used to be in the order of 5, 6, or 7 years—about 5 years to take the low side.
>
> That would mean, say, 2 to 3 years of funding for some approved experimental research and development purpose. That would be the first area.

Dr. PERKINS. I would say "amen" to that.

Senator JACKSON. You concur in that?

Dr. PERKINS. Yes; and there is a second point about budgeting that gets us into the NSC. We have made the point about the impact of fixed ceilings, and its impact on security planning. But there is a widely held view, as you well know, in the operating departments that the budget officers carry too much weight, and that the Director of the Bureau of the Budget and the Treasury Secretary in the NSC carries too much weight.

I would like to speak to both sides of that issue, if I may, because there are two sides: One, I think that people who talk about the budgetary tool as being one that the President should not use are talking sheer nonsense. The budget system and the budgetary tool is an indispensable tool of management and control, and of checking up on what you have, and seeing to it that there is some connection between costs and performance.

So those who are concerned about the role of the Bureau of the Budget, I think, are either wrong or they are misplacing their concern. If you are dissatisfied with either budgetary ceiling or with the views of budgetary officers, you should lodge your complaint with the people who use it, and not with the tool.

I think here we deal with a much more complicated issue. It is my general view, Senator, that the idea of the budget ceiling has been used as a shortcut means of dealing with a very tough problem of making a choice between complicated weapons systems.

Now, in short, I think, therefore, that while the complaint that the budgetary tool is inappropriate is wrong, I think a case can be made that the substitution of budget procedures for substantive decisions is equally wrong.

Senator JACKSON. That goes to a very good point, and I think anyone who is realistically informed about the operation of Government realizes that the budget tool can be a very useful tool when properly directed and operating from policy decisions that have been thoroughly considered, and thoroughly debated, and that meet overall requirements.

Would you agree with that?

Dr. PERKINS. Yes; I would.

Senator JACKSON. Do you have any further comments?

Dr. PERKINS. No; I do not.

Senator JACKSON. I shall ask the minority counsel, Mr. Pendleton, if he wishes to ask any questions, Mr. Pendleton?

Mr. PENDLETON. Dr. Perkins, you mentioned at the beginning of your statement in this executive hearing that, prior to the session, you had spoken to the staff of this committee and Mr. Haskins. I was wondering whether you had prior to this session spoken either to Senator Mundt or Senator Javits or to me?

Dr. PERKINS. No, sir.

Mr. PENDLETON. Throughout this discussion in executive session you have referred to the President. Do you mean by "the President" any particular occupant of that position?

Dr. PERKINS. I was talking about the Presidency.

Mr. PENDLETON. And not the present incumbent in particular.

Dr. PERKINS. No, sir.

Mr. PENDLETON. In discussing the operations of the National Security Council, would you state the basis of your knowledge of the operations of that Council?

Dr. PERKINS. My first contact came as in the Pentagon, when I was first consultant and then deputy chairman of the Research and Development Board. In order to discharge my responsibilities, I was given a whole series of National Security Council papers that bore on the dimensions of the responsibilities of the Department of Defense. I must have read about 25, I would guess, such papers and amendments thereto.

So there was a period when I was thoroughly familiar with not only the papers, but the procedure by which those papers were developed and of the development of papers in the Pentagon for the Security Council.

My second large exposure came through the Gaither Committee, and I will not say any more than that for fear of getting into trouble. There may have been an NSC paper that bore on our security program that I did not see during the summer, but I do not know what it was. I had a chance to see both the Planning Board and the Security Council itself in operation, but more importantly, I had a chance to discuss, since we were very much interested in finding out how our report could be of most use to the Security Council, how the thing worked.

Of course, there is a good deal in public print about the Security Council. Fortunately, a good bit of it has now been put together

in your very excellent committee document entitled "Selected Materials," but before that I had a chance to read Mr. Cutler's statement about how the Council operates, and Mr. Gray's statement when they appeared in Foreign Affairs magazine.

Mr. PENDLETON. And, Doctor, in the course of your experience, have you attended meetings of the NSC?

Dr. PERKINS. One.

Mr. PENDLETON. You referred to a question of the discussion between the people participating in the operations of the National Security Council, and the question came there.

Dr. PERKINS. Will you repeat that again?

Mr. PENDLETON. You referred in your discussions to the participation between the attendants at NSC meetings. The question arose in my mind on the opportunity for the operating heads of the agencies to discuss policy versus the presentation of a compromise decision at the NSC level.

I believe your statement was in regard to the presentation of a compromise rather than the opportunity for the Secretary of Defense and the Secretary of State and other members of the NSC to discuss the issue.

Do you believe that it would be more advisable for policy recommendations to be made by other people than the heads of the operating agencies?

Dr. PERKINS. That is a very good question, and a very complicated one, and it requires a complicated answer.

There is a wide division of opinion, as you know, about such matters. There is one school of thought that says you ought to have a series of senior officers, with no operating responsibility. There is another that says that you get your best advice from those who are in the middle of operations.

I am with the latter school. I think that you do get your best advice from people who have large operating responsibilities; at least you have a chance to make sure that you are getting the benefit of advice that comes out of considerable experience. The man who does not have any such connection has an important role, but not the continuing role that I would expect from, let us say, the Secretary of Defense, or the Secretary of State.

I would say, then, if I were the person who had to lean on advice, I would certainly want to seek it on a continuing basis, from the people who had the large operational responsibilities in Government. In that sense I think that the statutory membership, or those who are invited, at least some of them, represent on the average where you get your best advice.

No system is perfect, and no operator is ever one who is always the best possible administrator, and the freest and most creative thinker. So I think a person, when he looks over the people who are giving him advice, has to make shrewd judgments about each individual. Is this man really in addition to his large operating responsibilities also likely to be the most creative?

You know as well as I do that lots of times you answer differently depending upon the person. Now, a wise man who uses an advisory group will assess the capabilities of each of the persons who are immediately around him, and will decide where there are some deficiencies in his advisory system.

So my conclusion about this would be that a President, and I am not talking about any particular President, would do well to see to it that if he does not have the creative, imaginative advice that he needs, as well as the stable operational capability, from those who come to NSC affairs, he ought to invite into it not people who have other operating responsibilities necessarily, but maybe he has a staff assistant, and maybe the imagination comes in an under secretary some place, or maybe it comes from some other part of the Government, and maybe he has to get it from outside expert committees.

But he cannot afford, having made a survey of the kind of capabilities he has in his USC membership, he cannot afford to pass up the chance for getting creative, fresh, courageous advice into his system.

Mr. PENDLETON. That raises the next question, of course, and it involves the difficulty of getting both points of view, and that is the number of people who attend.

I believe at the present time among the 20 or so that attend the NSC, there is George Kistiakowsky, the President's science adviser. Do you believe it is better for him to be there, or does his presence and some of these other outside people create a mass atmosphere?

Dr. PERKINS. Well, is he going to appear before this committee?

Senator JACKSON. He will not appear, because of his position in the White House.

Dr. PERKINS. I think that I could not answer that without knowing Kistiakowsky better than I do. I know about him and I have met him.

Mr. PENDLETON. Any science adviser. I meant just anyone.

Dr. PERKINS. That is all right. I think there would be many times when if I were a President I would like to have a science adviser present when certain topics were up. I would not want him to feel that he was there because he had to register a point of view on all the matters on the agenda.

Mr. PENDLETON. Now, to close, to turn to Mr. Bowie's statements on page 105, the first question there in regard to the policymaking problem—do you believe that the United States in its foreign policymaking should or should not consult with its allies and with the Congress?

Dr. PERKINS. Of course it has to. The one way in which you develop a consensus in a democracy is by dealing not only with your legislature, but with other private organizations whose knowledge and know-how about what the Government is doing is imperative.

I would also take it that we are the leaders of the Western alliance structure. For us not to consult our allies would be sheer murder. Bowie, of course, is perfectly correct in saying that we have to consult Congress, and the allies, and different parts of the Government.

Mr. PENDLETON. And then the final point is point number 2 there, in regard to the procedure of NSC on existing papers and policy. I would like to refer you to page 55 of "Organizing for National Security: Selected Materials," where Mr. Cutler discussed this, and I am sure you have seen that. The fourth paragraph there says:

> Moving farther along the spectrum, we find the continuing review of all policies, including those approved by President Eisenhower. A national security policy is not created to be put in a glass museum case. As world events shift or take on new emphasis under more recent intelligence reports, there is need to subject policies to a fresh look. Periodically the Operations Coordinating Board reports to the Council on departmental and agency progress in carrying out currently

operative national security policies, on its judgment of the adequacy of failings of such policies.

In the light of that statement, do you feel there is a continuing review of existing policy?

Dr. PERKINS. Mr. Cutler says there was during his time, and then there sure was, because he is a man of enormous integrity, and I would have no basis for quarreling with what he says. I would register a caveat, however, which is that policies that get reduced to paper and countersigned by a lot of people are harder to modify than ones that have not gone through some kind of paper validation process.

But I would say that Cutler is obviously right, that there is a system for review, and I just hope that the barrier I have described is one that he finds easy to surmount.

Mr. PENDLETON. You referred to Mr. Cutler's time. So far as you have personal knowledge, is there any change in that procedure at the present time?

Dr. PERKINS. I have no way of knowing. I have no reason to believe it has changed.

Mr. PENDLETON. Thank you.

Senator JACKSON. Thank you, Mr. Pendleton.

Well, Dr. Perkins, as I indicated in the open session, you testimony has been most informative, and it has been constructive. I can add that your testimony in connection with the NSC that we have taken here in executive session has been very thoughtful. I know you have spent a lot of time on this particular area of government machinery. I do want to commend you for it.

Dr. PERKINS. Thank you, Senator. I have enjoyed being here, and if I have been of any help I am most pleased.

Senator JACKSON. The committee will stand adjourned until 10 o'clock tomorrow morning when we will resume our open sessions.

SCIENCE, TECHNOLOGY, AND THE POLICY PROCESS

TUESDAY, APRIL 26, 1960

U.S. SENATE,
SUBCOMMITTEE ON NATIONAL POLICY MACHINERY,
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10 a.m. in room 3302, Senate Office Building, Senator Henry M. Jackson (chairman of the subcommittee) presiding.

Present: Senator Jackson.

Also present: Senators Gore, Church, and Bush.

Staff members present: J. K. Mansfield, staff director; Dorothy Fosdick, Grenville Garside, and Howard E. Haugerud, professional staff members; and Edmund E. Pendleton, minority counsel.

Senator JACKSON. The subcommittee will come to order.

This morning our subcommittee goes into its second day of public hearings on the subject of how our Government can best gear science and technology into foreign and defense policymaking.

The question now before this subcommittee is this: What is the right way to organize our Government to get the right scientific and technical programs at the right time?

Yesterday we heard from Dr. James A. Perkins, vice president of the Carnegie Corporation. Our first witness this morning is Dr. James B. Fisk, president of the Bell Telephone Laboratories and vice chairman of the President's Science Advisory Committee.

Dr. Fisk has combined a distinguished scientific career with notable contributions to the Government service. Most recently he has been intimately involved with the complex problems of disarmament. He served late last year as head of a technical group at the Geneva Conference on the discontinuance of nuclear tests.

In 1958 he was chairman of the Western delegation at the Geneva Conference which studied the possibilities of the technical violations of any agreement on test suspensions.

With this background, Dr. Fisk is admirably qualified to discuss some of the new problems we face in science, technology, and the policy process. The Chair might add that Dr. Fisk has been involved in many great and outstanding research activities bearing on the broad challenge to our national security.

He heads the largest laboratory in the world, and he is a distinguished administrator, and he is a distinguished scientist, and it is a real pleasure, Dr. Fisk, to have you with us this morning.

You may proceed in your own way.

STATEMENT OF JAMES B. FISK, PRESIDENT, BELL TELEPHONE LABORATORIES, AND VICE CHAIRMAN, THE PRESIDENT'S SCIENCE ADVISORY COMMITTEE

Dr. FISK. Thank you very much, Senator Jackson. I am very glad to be here.

I have a prepared statement. Perhaps it should not be dignified in that way. It is really an elaboration of notes. If it suits you, sir, I would like to follow that statement.

In your letter to me of April 11, Senator Jackson, you have raised a number of difficult and important questions, principally concerned with the planning and coordination of scientific and technical activities of the Government.

The first three of these questions mentions the President's Science Advisory Committee explicity, as well as the National Academy of Sciences and the National Science Foundation, and raises also the possibility of giving the President's Science Advisory Committee some statutory underpinning.

I would like to discuss this question, beginning with a few general observations.

Science and its applications—that is, the technology which science generates and supports—are essential functions of many of the operating agencies of the Government today, in Defense, Commerce, Interior, the Atomic Energy Commission, Health, Education, and Welfare, and the National Aeronautics and Space Administration, and so on.

Understanding of science and technology has become increasingly important to the Department of State, and a number of agencies exist only because of science and technology. For example, there is the Atomic Energy Commission, the National Science Foundation, the National Aeronautics and Space Administration, and indeed the Federal Communications Commission.

The Treasury Department and the Bureau of the Budget and even the Justice Department are continually faced with matters of high technical content.

Science can be viewed as one major element in our total national life. Or it can be viewed as a means to accomplish certain objectives. It is both, and both are important. We must avoid the danger of too much planning of our national science, but we must find more effective mechanisms for overall comparative judgments of national priorities.

To imagine that "science" as a whole could be abstracted from Government departments and agencies and set up somehow as a separate department—a Department of Science—is, I believe, unrealistic. It would be somewhat analogous to abstracting "economics" from these departments and agencies and forming a Department of Economics.

In saying this, I do not mean to imply that we have evolved the best mechanisms for handling our scientific problems, or that all scientific and technical activities have their best possible homes; or that all urgent technical undertakings are being carried out.

This would be unreasonable to expect because the nature and scope of these activities keep changing as the world moves ahead, and

Government needs constantly to adjust its mechanisms to keep up with changing conditions.

Nor do I imply that there is no need for comprehensive analysis, planning and review of our total scientific and technological activity, and the costs of such activity in Government.

I am saying only that a separate, comprehensive Department of Science seems to me to be inappropriate as an operating mechanism. I see no single, simple, administrative solution. But there are several administrative matters which, in my view, merit consideration.

First, regarding the analysis, review and advice concerning the overall science and technology within Government, in the recent past this function has been exercised in part by the President's Science Advisory Committee. The President's Science Advisory Committee is not a statutory body. It is not an operating agency. It is, as its name signifies, an advisory committee appointed by the President.

It has attempted to analyze, review and advise on numerous matters of high scientific and technological content, and it has attempted to look more broadly and on a longer time scale at science and research, and education for science and technology in the United States.

I believe that the functions which this committee has performed have been useful and constructive, even though because of limitations of time they have not been as comprehensive as might be desired.

I further believe that the functions of the President's Science Advisory Committee could be usefully extended. Therefore, I would suggest the establishment of the President's Science Advisory Committee by statute be considered, although the President's Science Advisory Committee has discharged its functions without statute and could continue to do so.

These functions might very well include the review and analysis of overall science and technology programs of the Government; to suggest priorities; to foster important fields of science which are undernourished and, incidentally, to identify those fields or those projects which perhaps are overnourished; to recommend initiation of projects whose ultimate utility may be foreseen; to advise the President on such matters; to enlist the National Academy of Sciences in its studies; and to work with the National Science Foundation and the recently formed Federal Council for Science and Technology to develop uniform practices where uniformity is desirable.

Now, a second area which I would like to say a few words about concerns the ways in which science and particularly technology can best serve specific national purposes.

Many competent people have observed that in areas of science and technology, where the Soviet Union has chosen to focus its talent and resources, it has done very well indeed.

For example, in science they are distinguished in mathematics, nuclear physics, inorganic chemistry, oceanography, and in other fields.

In World War II, where their needs were very great, they did excellent work on tanks, artillery, fighter aircraft, and so on. And, of course, more recently and very well known has been their performance with rocket motors, ICBM's and space vehicles.

It seems to me that the principal lessons are that the Soviets seem to have made a very careful choice of objectives, and then provided for focus and concentration.

The real question for us is this: Can we identify the truly significant national military and other objectives, then organize to focus our best technical efforts toward their achievement in order to insure the best supporting science and technology?

Please note that I am not now addressing the important question of science as a part of our culture, or as the unique source of whole new and unexpected advances; rather, I am talking about the ways in which technology and applied science can best serve specific national objectives.

By way of example, it seems to me that there are three dominant national military objectives for which we must be prepared. They are:

1. Defense of the homeland, or continental defense;
2. Long-range strategic warfare;
3. Military aid to our allies, or "limited war" capability.

These three are likely to remain as national military objectives indefinitely into the future. The three functions, or objectives, do not overlap one another in any very significant way. Yet each involves all three of our present armed services and each involves the technical developments stemming from the three services.

As a digression, I might observe that "competition" is a part of our American way of life. But internal competition is not the only spur to performance. Our real competition is external. We must never let internal competition divert us or weaken us in meeting our primary objectives.

One of your questions, Senator Jackson, bears on this matter; namely, the question concerning creation of the post of Director of Defense Research and Engineering. I believe this to have been an important step. Further, I am glad to see that Dr. York has organized his office in a manner consistent with the main point which I am attempting to make.

Thus, from the viewpoint of technology and science, increased focus is being provided. Focus is also being brought to broad functional areas—for example, communications—where common systems can serve many, if not all, operational requirements.

Now, the third point I would like to make, and finally, is that there is a question in the list which you sent to me concerning arms limitation, and the scientific and technological considerations involved.

These complex questions—in which science and technology are only a part—are extremely difficult, and of paramount importance. I do not believe that we can afford, as a country, to leave such matters primarily to ad hoc groups, even though they have provided very valuable help.

Continued study, analysis, experimentation, all are essential, closely knit with the political, military, economic, and other matters, from which the scientific and technical cannot be divorced.

Further, it seems to me that while the Department of Defense and the Atomic Energy Commission will always have a great interest and responsibility and will make contributions in this field, they should

not be expected to carry the burden both of maximizing and, simultaneously, minimizing arms.

I look for steps to be taken which will greatly strengthen us in future negotiations on disarmament.

These were the prepared remarks, Senator Jackson, which I had intended to make.

Senator JACKSON. Thank you, Dr. Fisk. I want to commend you for a most informative and a very fine analytical presentation of the questions that we put to you.

I would like to welcome to the committee this morning two distinguished colleagues from the Foreign Relations Committee, Senator Gore and Senator Church. Senator Gore has another committee meeting to attend, Dr. Fisk. He is in a position like many of us with several committee meetings on at the same time. In view of the fact that he must attend another meeting, I will turn to him first to ask some questions.

Senator Gore has taken a particular interest in disarmament, not only on the Foreign Relations Committee, but also on the Joint Committee on Atomic Energy.

Senator GORE. Thank you, Mr. Chairman.

Dr. Fisk, I gather the impression from your statement that you regard in this period through which we are passing an unplanned scientific program as being essentially on the defensive, vis-a-vis the United States and the Soviet science program.

Yesterday I heard, and I am sure you either heard or read the statement of Mr. de Gaulle, who advocated that we first deal with the missiles, the vehicles of delivery; that this should take priority over agreement on nuclear tests, and the nuclear warhead.

Our Government, as you know, along with Great Britain, has taken the view that we should first deal with nuclear tests, and the international conference is underway upon the initiation of President Eisenhower.

Now, what, in your opinion, is the realism involved? Which is the more important disarmament or, indeed, are they inseparable—the nuclear warhead or the ICBM or ICM, to deliver a nuclear warhead?

Dr. FISK. Senator, this is a very difficult question to answer. I grant you it is an extremely important question. It bears on what I have said here this morning, principally, I believe, in this way:

I feel that it is terribly important for us as a country to examine just such questions as you have now asked, to do it on a continuing basis with intelligent and dedicated people, well focused on problems of arms limitation and disarmament.

As of today, most such thinking has come from rather hastily organized ad hoc groups and these problems are too difficult, altogether too difficult, technically and militarily and politically and otherwise for any short-term view to come up with a sensible answer.

For the same reason, I feel that my own knowledge in this field is inadequate to give a good, well informed answer to your question.

Senator GORE. Then my deductions from your statement are reasonably accurate, that you feel it is necessary to have a carefully organized and planned program of science, of development, research and a careful program for planning this Nation's policies in this par-

ticular field with specific reference to disarmament and national security.

Dr. FISK. Yes, sir; I do. I feel that we could very well afford to spend perhaps 1 percent of the amount of money we spend on defense for this purpose.

Senator GORE. I think that I agree with that.

Now, you have said in response to my question that it is a difficult one and one which cannot all be answered on an ad hoc or temporary basis. You have also said that you do not feel capable of providing an answer now.

I can respect your opinion, but having seen you perform in Geneva and have heard you testify upon several occasions, I know of no one whose opinion I would respect more, even when given impromptu.

Therefore, I wish to inquire further. With respect to disarmament, do we have a careful plan of which you are aware or do we not?

Dr. FISK. I have not been a part of any study in this field nor am I familiar in detail with the status of our overall disarmament plans. My own association with a limited portion of this field has been solely on the technical aspects of the nuclear test ban negotiations.

So I am not, or I do not feel, Senator, that I am qualified to answer your question.

Senator GORE. Well, I will not press that on further.

Let us go to the specific question of nuclear test bans. Efforts are underway to reach agreement in this field. Most all men of good will must hope that a realistic agreement can be reached.

What meaning would an agreement on tests have, in your opinion, if there is no agreement on the use of the stockpiles presently in hand and further developed of rocketry and missiles to deliver those?

Senator JACKSON. Senator Gore, I just wanted to interrupt at this point. I told Dr. Fisk, and I will let him answer this any way he wants, that for the most part we would confine our discussion today to the mechanisms and the procedures in this broad area where science plays a most important role in national security.

I merely wanted to mention that because I did not have time to explain to Senator Gore the primary role of your appearance here today.

Senator GORE. Thank you, Mr. Chairman.

It is certainly not my desire to press Dr. Fisk to give answers which he is reluctant to give. From his testimony, it seems to me or I received the impression from his testimony that he felt the urgency for the need of careful organization and careful planning for an intelligent and provident disarmament program. Is that correct?

Dr. FISK. Yes, sir.

Senator GORE. And I asked this specific question because only yesterday we witnessed this wide divergency between our distinguished visitor and our own Government and Great Britain with respect to this particular problem. That is why I was undertaking to elicit from you some relation of this particular problem which apparently is being dealt with on an ad hoc basis, and not too much success.

Here is an example, it seems to me, a primary example for the need of planning and programing. I would be glad to have your comment on that.

Senator JACKSON. That is fine, as to procedures, and I want to say this: that Dr. Fisk, I think, is prepared to testify in general on procedures and mechanisms. I think what he wanted to stay away from, and I say this because Dr. Fisk wants to be very fair, but I think that he may have some reluctance just prior to meetings coming up to get into substantive matters.

I know he would be happy on this question, I am sure, to comment regarding procedures and the approaches that should be made.

Senator GORE. I will invite whatever comment you would be pleased to offer, Doctor.

Senator JACKSON. I am not acting as a censor here; I just want to be fair to Dr. Fisk, because our role is entirely related to machinery, but we do have to have a substantive base from which to start.

Dr. FISK. And otherwise there is no need for improvement of the machinery.

Senator GORE. Well, I have provided one.

Dr. FISK. I think it is terribly important for us to examine this whole collection of problems of disarmament, arms limitation, and so on, to determine what are the most important first steps, and how do you do them, and what are the interrelationships between science and technology, which is only a small part of the questions of control and monitoring, and what is the relationship between the technical aspects, and the political and military and economic and other aspects?

How can we really bring to bear the real strengths of our country to understand and provide a basis on which we can go ahead forthrightly and safely?

A great deal of the good work is done, and a great deal of good thinking is done in the Government and elsewhere. But I feel that we have no central focus for this, no way in which we can draw in the kind of talent that this problem demands and deserves. This is my point, Senator.

Senator GORE. I think that I agree with you there, Doctor, but with or without focus we are engaged in an international conference right now with several other powers on the problem of disarmament. A summit conference is to be held within the next few days, and the leader of France is here, and the leader of Great Britain has just been here, and the leader of Russia has been everywhere.

Although we may not be in focus, I think it is necessary, as you say, for this country to develop carefully a modus vivendi of bringing the problem into focus and making our own long-range plans to meet the problems.

Dr. FISK. Please understand, Senator Gore, I am not asserting that we have done badly. I am simply saying——

Senator GORE. You are asserting that we have acted, shall I say, in an ad hoc manner.

Dr. FISK. No. I am simply saying that the problems are too difficult, as I discovered in my own service as a delegate. The problems are too difficult and too complicated to treat lightly. I think we have learned some lessons.

What I am saying is that these matters deserve much greater and much more concentrated attention in the future.

Senator GORE. I have one further question, and I shall desist.

You and I were in Geneva, and here is a problem on which we focused to the extent of our ability, a problem on which our Government focused to the extent of its preparations, to the extent of its plans.

My question is, from your observation, was the U.S. Government adequately prepared for the nuclear weapons test conference which began November 1, 1958, when it began?

Dr. FISK. Are you now speaking, sir, of the political conference?

Senator GORE. Yes, which was based, of course, upon, shall we say, the findings and compromises and the views of the technical conference.

Dr. FISK. There were no compromises in the technical conference that preceded the political conference. The foundations, technical and scientific, which were then available to the political conference were those based on the best technical evidence which we then had.

As we know, subsequent information showed that we had been somewhat too optimistic. I feel that we perhaps should have at that time developed a program to support our political negotiators which might have put us in a better position today than we are in.

Senator JACKSON. Dr. Fisk, might I interrupt at this point to say that the Department of State has been very candid on this point, and I thought that I just might mention to you that when Mr. Hare, representing the Department of State, appeared before the Appropriations Committee in February of this year, the House Appropriations Subcommittee, they asked for $400,000 for disarmament studies. That is a $400,000 item for disarmament studies.

He made this statement, which I think corroborates your very frank presentation of this problem, and I quote from page 111 of the hearings:

> What is lacking is a sustained study effort concerning the effect of various possible arms control agreements on the United States, allied and Soviet capabilities, together with future exploration of new possibilities of arms controls which might enhance U.S. security.

I think this statement corroborates your testimony here this morning, and it is the official position of the Department of State.

Excuse me, Senator Gore.

Senator GORE. Well, Doctor, there is one thing that has perplexed me and I wonder if you have an explanation. Our Government took a position with respect to all tests, and the stoppage of all tests in Geneva on November 1, 1958.

Only a few days prior thereto, and perhaps that may be one explanation, it was only a few days prior thereto, the Hardtack series of tests were conducted which rendered the scientific base of our position as of November 1, 1958, as you have said, unrealistic and unfounded.

Would it not have been better to have had the results of this test properly, shall we say, analyzed or extrapolated or whatever term is appropriate, before taking a position? Should the convening of the conference have been postponed until after this information could be analyzed, or should the tests have been held sufficiently advanced before that time?

Just how did we get, if you can say as a scientist, how did we get into this position of going to Geneva on November 1, 1958, with a

position which at least some scientists in our Government knew at the time was unrealistic and unsupported by the new evidence?

Had it not been sufficiently analyzed for our Government to know it, or was this bureaucratic slowness in adjusting to new facts? Do you have an explanation for it?

I am not asking you to defend anything or take a partisan position. If you know the answer to it, I would like to have it.

Dr. FISK. You have asked me a rather difficult question which involves judgments and decisions. A decision was taken so far as I am aware before the Hardtack series began; namely, in August, but it is not true——

Senator GORE. You mean the political decision?

Dr. FISK. To hold the conference on November 1.

Senator GORE. When was the position taken, the decision on the position? Do you know that?

Dr. FISK. I am not sure that I know exactly what you mean, sir. The decision to proceed with political discussions, I believe, was taken on August 22. However, let me, if I may, correct one point which you have touched on, sir.

The basis for all but the small underground tests has not been challenged. The results on which this decision was taken in August are still valid so far as I am aware. There has always been some threshold below which everyone has known it would be extraordinarily difficult to detect underground tests.

This we thought in Geneva in 1958 was perhaps 5 kilotons under most circumstances, with some smaller probability of 1 kiloton. The results of the Hardtack series showed that 5 kilotons was probably not right, and it was more nearly 15 or 20 kilotons. That is what the Hardtack series showed, with respect only to underground tests.

So the rug was not completely pulled out from under us. A small portion of the rug disappeared.

Senator GORE. Do you think that this is an example in which a more carefully organized and planned program could have brought the subject matter into sharper focus and more careful analysis and position as a result?

Dr. FISK. I think, sir, we learned this as a result of our activities in Geneva.

Senator GORE. Thank you, Mr. Chairman.

Senator JACKSON. Thank you, Senator Gore.

Dr. Fisk, I wonder if I could put this question to you: Would it be fair to say that we face a broad challenge from the Sino-Soviet bloc, that is, militarily, and also economic and psychological, and on the disarmament problem, and I take it that just as we must plan for a military defense and just as we must be prepared, if necessary, to engage potential enemies in the economic field, we must obviously be equally and competently prepared to deal with this broad challenge of disarmament.

Is that a fair statement? It started out to be a question.

Dr. FISK. I accept your statement.

Senator JACKSON. That has to do with the importance of disarmament.

Would you feel that disarmament is a part of this broad Soviet, or Sino-Soviet, challenge?

Dr. FISK. I have no reason to believe, in terms of my own experiences, which are limited to dealing with the Soviets, a small group of their scientists—I have no reason to believe that they are not very much interested in arms limitation. It seems to me we have every reason, both internally and because of this demonstrated or presumed interest on the part of other countries, to understand every aspect of this very difficult question.

My main point has been simply that as we have learned in the past several years, and as we have found how difficult these problems of monitoring and control are, and how difficult it is to separate them from the broader political and military and economic kind of questions, I think it has been very clearly demonstrated that we need to do more, and a great deal more, in a more consistent and continuing way than we have done so far. This is a rather wordy answer to your question.

Senator JACKSON. I can probably state it another way: That what you are saying is that we must be competently prepared to deal with the problem of disarmament just like we must be competently prepared to provide for an adequate defense.

Whatever we go into, we must realize that preparation and the adequacy of it is essential as it bears on our national security.

Dr. FISK. That is right.

Senator JACKSON. Now, I wonder if I might ask a couple of more specific questions.

Can you give any indication in a more specific way as to our main shortcomings in organization for disarmament whereby we can profit in the future? I ask that question in a spirit of fairness, because this is a new adventure for us, especially in this scientific facet of disarmament.

This country has been in disarmament conferences before, but never have we had to face such a difficult problem in the area of disarmament.

I particularly wanted to commend you for your statement that we could afford to spend at least 1 percent of our defense effort in disarmament. I think when we do that we also provide for our own defense, if I may state it in a rather contradictory way, or what might appear to be a contradictory way.

Dr. FISK. They are very closely related. I do not believe, Senator Jackson, that I have any really specific points to make here. We have learned by experience that the probems are tougher than anybody thought.

All I am suggesting is that we should take advantage of the experience we have had so far and insure that we are prepared for any future negotiations, as well as we can be.

I have nothing really specific. I am sure that this point is understood by many, many people in Washington and I have no reason to believe that our experiences of the past will be not taken advantage of.

Senator JACKSON. Some substantial improvements are now underway; are they not? I believe there was a new setup announced not too long ago, or a few weeks ago, to better coordinate the effort.

Dr. FISK. I am not familiar with the details, Senator, but I would be very much surprised if very active steps were not being taken here.

Senator JACKSON. We are, of course, providing a small sum, I believe the House has approved the $400,000 to aid the Department of State in its effort in doing further work in this field. I was particularly intrigued by your statement where you said:

> Further, it seems to me that while the Department of Defense and the Atomic Energy Commission will always have a great interest and responsibility and will make contributions in this field, they should not be expected to carry the burden both of maximizing and, simultaneously, minimizing arms.

I think that is an unreasonable burden on those departments. I wonder if you could elaborate a little bit on that?

Dr. FISK. Well, it seems to me a fairly basic principle of organization that you can hardly expect the man who is asked to sharpen his sword to use the same stone to dull it.

Senator JACKSON. There might be a slight conflict of interest, or of human interest, and very understandably so.

Dr. FISK. Now, this does not mean that there is not a great responsibility and interest on the part of everyone in this matter. But to imagine that the man who is asked to optimize our military strength should simultaneously be asked to limit it, I think is asking too much.

Senator JACKSON. All right. I will defer my questions. Senator Church has a question. Senator Church is also a member of the Foreign Relations Committee. He has taken an interest in these broad problems.

I just want to mention again, Senator Church, that our primary mission in this committee is to try to improve the organizational structure bearing on the broad challenge to our national security.

Senator CHURCH. Thank you, Mr. Chairman. I want to follow up with Dr. Fisk the line of questioning that you commenced a minute ago, but let me say in the way of a preface that I remember a long time ago when I was a boy and collected model ships that it was often said that our battleships constituted our first line of defense. So I collected models of battleships.

Then Pearl Harbor came along, and the attack upon our battleships was 90-percent effective. We did not get any battleships into service for more than a year, or 18 months, after the attack, and the war in the Pacific was won without them. The main reliance was upon submarines and aircraft carriers.

So sometimes the notions that we have with respect to what most contributes toward national security are very ill founded. I think perhaps today it is not a misstatement to say that effective and enforcible disarmament is our first line of defense because the alternative degree of security that armament brings is so pitifully poor compared to what security we would have with effective and enforcible disarmament; that this ought to be the primary goal of every effort directed toward promoting national security.

Would you think that a fair statement so far as the assessment of priorities are concerned?

Dr. FISK. I certainly feel that we cannot afford in this country to leave any stone unturned in understanding this whole complex of questions of arms limitation. I see no security and no real stability in a continuing arms race.

Senator CHURCH. I am fully in accord with you on that.

Now, with respect to the procedural arrangements in the pursuit of the control of arms, I, too, have been drawn to the statement that you made in your prepared remarks when you said that you did not believe that we can afford, as a country, to leave this matter primarily to ad hoc groups.

Then you said further:

> It seems to me that while the Department of Defense and the Atomic Energy Commission will always have a great interest and responsibility and will make contributions in this field, they should not be expected to carry the burden both of maximimizing and, simultaneously, minimizing arms.

Now, if I could take that general statement and apply it to one or two specific situations, let me ask you this question: At the present time it is my understanding that the Atomic Energy Commission is charged under the law with ascertaining the degree of radioactive fallout in the atmosphere and of determining the extent to which such fallout may constitute a hazard to the public health.

Inasmuch as this matter weighs heavily upon public opinion everywhere in the world and is felt to be a real and provocative source of anti-American feeling, and certainly was a major factor in bringing on the negotiations at Geneva, do you feel that this is the kind of responsibility that ought properly to be exercised by the Atomic Energy Commission, or is it, by its nature, a responsibility that could better be exercised by an independent agency that is more directly charged with the duty of protecting the public health, such as the National Institutes of Health, or some agency under the Department of Health, Education, and Welfare?

In other words, is this a logical place for a division of authority; to ask the AEC to conduct this kind of test and make this kind of assessment is rather like asking the prosecutor in a case to be the judge, is it not?

Dr. FISK. Well, it would seem to me entirely reasonable for the collection of information to be handled, as I believe it has been in the past, by the Atomic Energy Commission. The question of what tolerance is acceptable and things of that kind it would seem to me to be more appropriately handled by the Department of Health, Education, and Welfare, for example.

Senator CHURCH. We are still in agreement then, Dr. Fisk.

Now, I am told at the present time there are relatively few people in the Government engaged directly in the matter of disarmament, and that the largest group that we have, although comparatively very small, is a part of the military with offices in the Pentagon.

I think you have already made your position clear, if I can paraphrase it, that to expect the military to both sharpen and dull the sword is rather like expecting the National Distillery Association to be the proper agency to head up a drive for abstention.

Would you think that we ought to create within the Government an independent agency or an independent group operating, let us say, under the jurisdiction of the State Department that would channel the necessary work that relates to the scientific aspects of disarmament, let us say?

Senator Kennedy has made a proposal of late that we should establish a kind of national research organization for peace and give it sufficient funds and personnel to thoroughly examine these complex

technical problems that are involved in the establishment of an effective inspection and control system for any kind of disarmament plan.

He points to the lack of adequate and sustained research in this field. He relates this to the difficulties that we have encountered, for example, in Geneva.

So he proposed that we set up this National Research Organization For Peace that could carry on sustained work under the general direction of the Department of State. What would be your reaction to this kind of effort?

Dr. FISK. In general terms, Senator Church, I would strongly endorse it. Precisely where it should be set up is another matter which seems to me to be somewhat secondary. However, I would urge this:

I think that it is unrealistic to imagine that the technical and scientific aspects of these matters can really be drawn off to the side and examined without being mixed in as a part of the overall problem. I think that we must remember that the technical things are almost inextricable from the diplomatic matters.

For example, if you decide that you are going to talk about a certain scientific-technical matter, and not about some other, there is implicit in that decision a political component. These cannot be handled effectively without very close cross linkages.

So I would urge that when we set up whatever may be set up, that the whole cross section of talent and the whole cross section of problems be included.

Senator CHURCH. I certainly agree with that. I think perhaps it was that consideration which led Senator Kennedy to propose that this be established under the auspices of the State Department so that the research activity could be carefully and intimately correlated with the political considerations that were involved.

That is all I have, Mr. Chairman.

Senator JACKSON. Thank you, Senator Church.

Senator Bush, we are very pleased to have you with us.

Senator BUSH. I was not here for the testimony, and I will not ask any questions.

Senator CHURCH. If I could ask one question, and for the record, and I do not know whether you can supply this answer, but knowing the astronomical amounts we are now spending for defense, I wonder if we could supply for the record and I would suggest that we do, some computation of the amount of money that is now being directly spent in efforts that are directly related to disarmament in the various agencies.

I think for purposes of comparison, those figures ought to be brought out in relief very clearly in the record.

Dr. FISK. Well, Senator, the amount is not trivial. There are, for example, very substantial programs which have just been commenced within recent months on seismology and the improvement of underground detection. However, the amounts that are being expended and the effort that is being expended in this comprehensive field, setting aside this seismological thing, is relatively small.

I think the $400,000 that was mentioned turns out to be something like one-thousandth of 1 percent of our defense budget.

Senator CHURCH. One-thousandth of 1 percent?

Dr. FISK. Someone should check my arithmetic.

Senator JACKSON. If the defense budget is $40 billion, the straight military budget, I think that would be correct.

Senator CHURCH. I think it may be fair to say on the basis of those figures that there is hardly any room at the inn for peace.

Dr. FISK. There are some extraordinarily competent and dedicated people in the Defense Department, and in the State Department and the various executive branches and, of course, here, who are very much interested and concerned, but nevertheless, taken altogether it is a rather small effort.

Senator JACKSON. Senator Church, I think that you have made a very proper request, and while the indivisibility of this problem is so enormous and, therefore, a breakdown accountingwise is a bit difficult, I do not see why we could not ask the State Department to supply us to the best of their ability with a reasonable estimate of what is going into the specific area of disarmament.

(The following letter was subsequently received from the Department of State:)

DEPARTMENT OF STATE,
Washington, June 1, 1960.

Hon. HENRY M. JACKSON,
Chairman, Subcommittee on National Policy Machinery,
Committee on Government Operations, U.S. Senate.

DEAR SENATOR JACKSON: In your letter of April 5, 1960, you asked the Department to obtain for your subcommittee as accurate an estimate as possible on how much the Federal Government is spending on disarmament.

As you indicated in your letter, it is indeed difficult to state a precise figure, since a number of agencies, their programs and personnel, deal with this problem in an indirect fashion. In view of this, the Department decided to base its estimate only on those funds directly allocated within the Federal Government to furthering disarmament efforts. On this basis the Department estimates the total sum for fiscal year 1960 to be approximately $19 million, the major portion of which has been utilized by the Department of Defense and the Atomic Energy Commission for research on the problem of underground test detection.

I might add that if it was possible to account accurately for indirect contributions made toward the Government's disarmament efforts, the above figure would obviously increase, although not by any substantial amount.

Finally, as a point of interest, I would note that the Federal Government's requested appropriations relating to disarmament for the coming fiscal year are some five times greater than the amount estimated above as allocated for fiscal year 1960. Here again, however, the greatest portion of the requested funds would be used by the Department of Defense and the Atomic Energy Commission for test detection research. There is included in this figure the sum of $400,000, mentioned in the transcript of the hearings that you enclosed, which the Department had requested to carry out urgent studies on disarmament.

I hope the foregoing information will be of assistance to your subcommittee.

Sincerly yours,

WILLIAM B. MACOMBER, Jr.,
Assistant Secretary.

Senator JACKSON. I think that it just corroborates Dr. Fisk's point that these thinks are indivisible, and when you are working on disarmament you are working on defense, and when you are working on defense—and I do not mean to quote you—you are working on disarmament.

It is like trying to separate the military and the civilian implications of new research in new areas, is it not, in some ways?

Dr. FISK. In some ways I would say yes.

Senator JACKSON. Now, Dr. Fisk, I wonder if you might comment in general terms with reference to the organizational structure in the Department of Defense.

I want to preface it by saying that those of us who have served on the Armed Services Committee feel in many ways the proper organization of the Department of Defense is like the problem of death and taxes, and it seems to be with us always.

I want to say, too, that this is a problem, as I see it, of all administrations. This has been going on from time immemorial and every President has had to contend with it.

Dr. Perkins yesterday made a couple of comments that I would like to refer to. In his testimony he made this point:

> Just as modern weapons require military knowledge in the State Department, modern weapons and derived modern strategy have made largely obsolete existing organization in the Pentagon.

Then he went on at the end of the paragraph and said this:

> The hard, unvarnished truth is that it has been impossible to assign tasks on a functional basis along existing service lines.

Do you not feel that part of this, and a very substantial part of this great problem we face in properly organizing for national security must some way and somehow be resolved in the Pentagon?

Dr. FISK. One of the primary problems, Senator Jackson, appears to me to reside there. I have thought about this question for some time. I had included a few words, perhaps somewhat too cryptic in my prepared statement, that relate to this matter.

I have tried to look at it primarily from the point of view of how best to support our national military objectives through technology and through science, rather than to pose as an expert on the organization of the Pentagon from a strictly operational point of view.

It seems to me that whether you are talking about the Department of Defense or one of the other departments, or business, or anything else, the first thing that you have to decide is what business you are in. I do not think that we can legitimately say any longer that the business we are in—the national military objectives—can be adequately organized in terms of method of transportation.

When you say that, it sounds facetious, and it grossly oversimplifies the matter, but nevertheless, the main problems facing our country from a military point of view do not divide naturally in terms of airplanes, tanks, or land vehicles, or ships. They are quite different.

Now, one of the problems that we have been faced with in the past and still are faced with is the problem of continental defense. Each of our present three services is deeply involved, and yet there is no direct way in which science and technology can focus on this collection of highly technical problems in any, I would say in the optimum way. It is done through rather tortuous routes.

Senator JACKSON. We had that problem up last week, Dr. Fisk. As I understand the present arrangement, it is that each service decides what they are going to contribute to the continental air defense, or North American air defense. But the overall operational commander, and he is under a unified command, does not initiate the budget to meet his requirements. He is merely advised in the end what will probably be recommended, and each service can likewise control what they want to put in and what they can take out.

Is that a part of this problem?

Dr. FISK. I think it is a part of the problem. As I mentioned in my prepared statement, Senator Jackson, I think that there is a recog-

nition commencing, and perhaps it has existed for some time, but there is certainly a recognition in the Department of Defense of some of these matters.

The organization headed by Dr. York, and the Defense research and engineering, is set up with focus on some of these large, major problems that the country faces, independent of a particular service.

The same argument, I think; namely, deciding what business you are in before you can really bring your forces to bear on optimizing, applies at almost any level of a major problem. But the important thing is that you must focus on what it is you want to accomplish as your ultimate objective.

We certainly do not have today an organizational framework that is ideal for that purpose.

Senator JACKSON. Well, I think that is a very excellent evaluation of the problem. I wonder if you also feel whether or not in that connection it is possible at the top to really balance out the requirements for the three areas that you mentioned; namely, the continental air defense, long-range strategic requirements for strategic warfare, and then the requirements for limited war, when each service decides within their role and mission what they are going to contribute?

In the end, is it not a very difficult thing, indeed, to try to balance what you are going to give to these three specific areas?

Dr. FISK. If these are the proper three, and this is my own private view, they may very well be the proper three.

Senator JACKSON. I do not think you have left anything out.

Dr. FISK. You might break out control of the seas in some way and separate it, but if these are the proper three, then it seems to me that they have to be looked at in terms of the objectives and not in terms of who contributes something from the sides.

Senator JACKSON. That is very good.

Now, Doctor, I want to commend you for your statement regarding a department of science. I think that we Americans have a habit of wanting to appoint a committee or set up a department to end a problem that is bothering us. I think this is a natural reaction.

Science is playing a very important role in this 20th century—that is, science and technology—and there are those who feel we will just set up a department and we will solve this whole problem of science and technology.

I was pleased to note your comments that you are opposed to such a department. It would be much like setting up a department of economics even through economics is in every department of the Government, and you would separate it and put it over into a separate department.

I think it is fair to say, is it not, that science has an influence in practically every department of Government today.

Dr. FISK. I believe this is a fair statement.

Senator JACKSON. And to try to put it all in one department would be—shall be say there might be a little bit of reaction and feeling from other departments that they are trying to intrude and it is not that easy to simplify it by putting it all in one place.

Now, I was also interested in your comment about the President's Science Advisory Committee. I want to say that I personally feel that the President's Science Advisory Committee has done a fine job.

I think it has served a most important purpose both under Dr. Killian and under the present director, Dr. Kistiakowsky.

I am concerned that the fine work that they have been doing be continued, and, therefore, I was very much interested in your suggestion that we should consider the possibility of a statute.

Is it not fair to say that we in this country do have at this time at least the advantage in scientific talent? The problem is the wise use of that talent. Is that a fair statement?

Dr. FISK. I think that is a fair statement, Senator.

Senator JACKSON. Now, Dr. Fisk, what has disturbed me is that there are so many scientific undertakings going on in each department of the Government, and in many ways they are limited by their own limitations within their respective departments.

It seems to me that at some point in our governmental structure some group such as the President's Advisory Committee should be in a position to know what is going on so that those resources, scientific resources, are properly utilized. Do you feel that this is essential?

Dr. FISK. I believe it is essential, and at least for the recent past in part this function has been provided by the Science Advisory Committee.

Senator JACKSON. Do you feel it has been helpful in trying to bring together the various undertakings by the various research departments within the Government?

Dr. FISK. I think it would be immodest for any member of the committee to answer that question.

Senator JACKSON. We will not treat it as a self-serving declaration.

Dr. FISK. I think that there is evidence that they have performed a useful function.

Senator JACKSON. And I take it it is also your position that it is helpful to be able to identify the critical and the important projects in this scientific area so that maximum pressure can, if necessary, be used, or maximum effort can be made.

Dr. FISK. There must be some mechanism somewhere to perform exactly that function, and it is often extremely awkward to ask any particular department or agency to do this. Someone must look at the overall collection of things and make some judgments.

Senator JACKSON. Isn't it also important, too, to eliminate some projects that are obviously costing money that we could save, and possibly interfering and detracting from critical and urgent projects?

Dr. FISK. It is extremely important, and not easy.

Senator JACKSON. And you cannot have departments reach over into other departments very well and make that decision. In the end it must be at the summit, at the Presidential level, and otherwise you run into this jurisdictional difficulty. Is this not true?

Dr. FISK. You certainly lose friends.

Senator JACKSON. Well, are there any other questions?

Mr. Pendleton, will you go ahead?

Mr. PENDLETON. Dr. Fisk, I concur heartily in what the chairman has said here about the action of the President's Advisory Committee. I think it has done a tremendous job in coordinating information on the scientific field of the Government, and in being advisory to the President.

I think that it might be useful for the record if at this point you could comment a little bit on the nature of the committee, what it does, and when it was created. Then at the same time tell us a little bit about the Federal Council for Science and Technology which I think does a job in a similar field, but not in the identical field, and comment on what it does.

I have the impression here that we have created the idea that there is not machinery to plan in the scientific field, and I think that that is understating the work that your group and the Council is doing. Could you fill us in a little bit on these two groups?

Dr. FISK. I would be glad to attempt to do that.

I would think it perhaps most effective to refer to several documents which have been issued either from the Science Advisory Committee, or talks that Dr. Killian or Dr. Kistiakowsky have given to give the detail of what the committee is and what it has done, and how it operates, and so on.

There is one such publication from the White House on "Education and Science," and another on "Research," and it was the second which recommended the establishment of the so-called Federal Council of Science and Technology.

The Council itself consists of responsible individuals from each Government agency or department which has a strong scientific and technical component. I have not been directly involved in the meetings of this group, but they do meet together to discuss common problems.

I think they have a useful function to perform in getting certain uniformities where uniformity is desirable. While I think the Federal Council has a useful function to perform, I do not think that the Federal Council can be expected to act as the analytical overall group which reviews and appraises Government programs in science and technology across the board. I do not think this can be expected for a number of reasons.

It is very difficult to be divorced from one's own immediate self-interest, and it is very difficult to get away from the day-by-day demands on time. Therefore, while I feel that the Federal Council has a useful place, I feel there is a real need for something like the President's Science Advisory Committee, composed in somewhat the same way it is now composed, that is, drawing from all fields, from all over the country, and on a rotating basis, so that one always has access to the entire technical community and to fresh ideas.

The people who have served on this to date have served with a great deal of time, and a great deal of attention to major problems, and I think even though it is a part-time group that they have been able to perform this review and analytical function.

Mr. PENDLETON. Do you believe the combined activity of the Council and the Committee has resulted in better scientific planning in the policy field?

Dr. FISK. I think the slope is positive. How much better is not for me to say. I think we have found mechanisms which have served usefully in Government.

Mr. PENDLETON. When you said the slope is positive, you mean the advent of these groups has brought about improvement in the field of policy planning where science is involved?

Dr. FISK. Yes, this is the shorthand way for a technical person to say just that.

Mr. PENDLETON. We are very limited in some of these terms and so you will have to help us to interpret.

I would like to read to you from the Wall Street Journal of Thursday, March 24, a comment from a very short editorial and then see what your reaction is to it. I am now quoting from this, that is, I will quote in part from this article:

"It is a gamble," Secretary Herter said of the May summit meeting. His attitude disturbed some of the members of the Senate Foreign Relations Committee where he was testifying.

There seemed to be some question that he was going without purpose, without hope of success, to the summit meeting. Now I will return to the quote:

Mr. Herter, however, had not said quite that. The U.S. purpose in going to the summit is that the state of the world is too dangerous to refuse to sit down and talk with potential enemies at any level. The United States plans to talk about a number of outstanding East-West issues like Berlin, and disarmament, concerning which the United States has rather definite policies. As for hope of success, that is indeed another matter.

It would be remarkably foolish to enter this meeting in an aura of optimism. This is so not only because of the almost total intransigence the Soviet Union has exhibited in the 15 years since World War II. It is also because, as Mr. Herter noted, it would be unrealistic to suppose that the Messrs. Eisenhower, Macmillan, De Gaulle, and Khrushchev could solve the great international disputes in a few days' time. The world would be entitled to deep misgivings if they announced they had.

For one of the dangers in a summit conference is that hope of success—the West's desire to abate the nuclear nightmare—will bring hasty agreements in which freedom is the loser. That is always the gamble in talking with the Soviets, and in some previous encounters freedom has lost. The best guard against that now is to approach the meeting, as Mr. Herter is doing, with a justifiable degree of skepticism and pessimism.

Do you agree with the statement in this editorial?

Dr. FISK. It would seem to me to contain quite a few statements.

Mr. PENDLETON. I will make it more specific.

Do you believe that Secretary Herter went to the meeting at the summit without a plan?

Dr. FISK. No, I am quite sure that the Secretary has thought about this very hard, indeed. I hope nothing that I have said would imply that this was not so. What I have implied and tried to say fairly directly is that these are difficult problems and they range over a great variety of fields, and you just cannot be too well prepared.

Senator JACKSON. May I make clear for the record that this committee is not assuming that we do not have mechanisms to do this job, that is, for science to play an important role in the Government. What we are trying to do in the course of the hearings is to improve mechanisms, and I hope we will always be in that position in this country.

I have tried to pay tribute to the President's Science Advisory Committee, and I think that they are doing a good job, and we want to help not only the President's Science Advisory Committee, but other mechanisms, to be improved so that this country's overall posture will always be at the best level.

I just wanted to say that.

Dr. FISK. I hope the remarks I have made, Senator Jackson, would be construed in the same way. We are looking for better mechanisms.

Senator JACKSON. And constructive suggestions.

Dr. FISK. Sometimes by way of example you will say something, perhaps about the Defense Department or the State Department, or whatever, to illustrate where it might be improved. This does not mean that it is entirely inadequate.

Senator JACKSON. Some of these problems have been with us for many, many years, and not only in this administration but in previous administrations.

Dr. FISK. Yes, sir.

Mr. PENDLETON. This is the sort of thing I did want to get into the record. Self-criticism is a great quality of Americans, and as long as we recognize that is part of our way of life, we will do all right.

Dr. Baxter, who was one of the earlier witnesses before this committee, made the following statement:

> President Eisenhower has made repeated efforts to break through Russian intransigences and obtain a satisfactory solution in the disarmament field. They include some of the most imaginative moves the United States has ever made on the international chessboard—the "Atoms for Peace" proposal of 1953, the "Open Skies" offer of 1955, the offer to Bulganin of March 1956, the negotiations for the suspension of nuclear tests, a very important proposal for safeguards against surprise attacks.

Do you have any further comments to make on the efforts that are being made at this time to work out something with the Soviet Union?

Dr. FISK. I do not believe I have any comments to be made here.

Mr. PENDLETON. Now, in your testimony you referred to the problem of the Atomic Energy Commission and the Department of Defense both maximizing and simultaneously minimizing arms. I think for agencies perhaps that does present a problem. On the other hand, I think that we should not overlook the fact that there are individuals connected with such agencies or formerly connected with them who do not, by their very connection, become inured to one way of life, either war or peace.

I think that you recall General Marshall, whose perhaps greatest fame was as a general, but you are aware of his efforts in the field of peace. I think we should not pass the fact here that he was granted the Nobel Peace Prize because of his efforts in that field.

Turning to the other agencies that are also concerned with disarmament and peace, could you tell us what people there are and what they are doing in the White House and the Department of State in the field of disarmament? I think that your main reference was to Atomic Energy and the Department of Defense. I think these other agencies should be referred to.

Dr. FISK. I do not have, Mr. Pendleton, a comprehensive knowledge of all agencies or very many agencies, or precisely what they are doing. My information is pretty well restricted to the nuclear test discussions and negotiations to which, of course, the State Department and the Department of Defense and the Atomic Energy Commission have all contributed a great deal.

I hope you will not misunderstand my somewhat cryptic remark about both maximizing and simultaneously minimizing arms. Perhaps that might have been expanded into a paragraph for further clarity.

But it does seem to me that to expect the Department of Defense or the Atomic Energy Commission to take a leading role in understand-

ing and working toward arms limitations is somewhat unreal. They obviously have great interest, and they have responsibilities, and they must always be a part of decisions, but you can hardly expect them to work with equal enthusiasm in both directions.

Mr. PENDLETON. But in the Department of State, which is also the department of peace, such as we have it, has not the Secretary there taken the leadership in this field by appointing a special assistant for disarmament and atomic energy?

Dr. FISK. Yes; and under his special assistant there is a small and able and very dedicated group.

Mr. PENDLETON. Thank you.

Senator JACKSON. I have just one point to cover. I think, Dr. Fisk, that we want to give serious consideration to probably some statutory underpinning to the President's Science Advisory Committee so that we can have the benefit of the fine work that they have been doing over the years.

Would you say that if that should be undertaken, the people who serve on the council or the Committee, many of them at least ought to be on a rotating basis, so that you would have the benefit of new faces and new ideas from time to time?

Dr. FISK. We have felt that this was a virtue. There has been, both on the present Committee and its predecessor, which has existed since 1952, a rotation. It takes off some very valuable members, but not permanently. It has real virtues.

Members have worked very hard and they have spent a good deal of time, and to ask one person to serve indefinitly perhaps has disadvantages. So I believe that rotation on some modest basis of 3 years, or whatever, is good.

Senator JACKSON. That is a director would come in for a period of 3 years, or whatever the case may be, and then rotate the members who will serve on it and have them come in for periods of time, to serve 2 or 3 years on it, on a call basis?

Dr. FISK. I think that the man who is Chairman—I might explain that the Chairman of the Committee has always been chosen by the members. Dr. Kistiakowsy, the Chairman, is the President's Special Assistant for Science and Technology, and this was the case with his predecessor, Dr. Killian.

Before that time the Chairman was whoever the Committee chose. Now, the Committee has chosen the President's Special Assistant who has been a member of the Committee in each case.

I think that this question should be examined. It has worked very well, but it would be quite dependent on the relationship between a special assistant and the man to whom he reported.

Senator JACKSON. That is very fine.

If there are no further questions, we will turn to our next witness, and before you leave, Dr. Fisk, I once again want to express the appreciation of this committee for your very fine and helpful and constructive and informative and last, but not least, candid presentation of your views.

I want to assure you that our objective is to try to bring about some constructive improvement in this all-important area, and to that end we are grateful to you, sir, for your help this morning. We will undoubtedly call on you again before we get through.

Dr. FISK. Thank you, Senator Jackson.

Senator JACKSON. Our second and next witness will be Dr. Pickering. I want to say that this afternoon we will reconvene to hear our third witness of the day, Dr. Mettler.

Dr. William H. Pickering is the director of the Jet Propulsion Laboratory at the California Institute of Technology.

Dr. Pickering has been associated with the laboratory for the past 16 years. He has been responsible for the direction of critically important programs in the missile field.

In addition to his work on Government scientific committees, he has served on a number of top advisory groups, and he is now a member of the Army Scientific Advisory Panel.

Dr. Pickering, we are honored to have you as a witness at our hearings this morning on the subject of science, technology and the policy process.

I believe that you have a prepared statement.

Dr. PICKERING. Yes, sir.

Senator JACKSON. You may proceed in your own way.

STATEMENT OF WILLIAM H. PICKERING, DIRECTOR, JET PROPULSION LABORATORY, CALIFORNIA INSTITUTE OF TECHNOLOGY

Dr. PICKERING. Mr. Chairman and gentlemen, I feel honored to be asked to appear before your committee. I believe that I should candidly admit that when I was first invited by Senator Jackson to express my views on the profound questions which this committee is considering, I approached the matter with some degree of apprehension. I do not consider myself, in the least, to be an expert on Government organization and the remarks that I have to make today are based essentially on my experience in the field of scientific education, my associations with the military service, and in managing a research and development organization now committed to advancing the national interests in the peaceful exploration and exploitation of space.

My experiences have caused me to develop certain definite viewpoints and I believe that possibly I can best serve the interests of this committee by highlighting some of these and expressing my opinion on what needs to be done to improve the national position in the increasingly important area of science and technology.

I should like first, however, to express several personal convictions which I hold. I shall not elaborate on these since I am sure that other competent witnesses before this committee have treated most of these in considerable detail. I recount them here only to provide a frame of reference for my remarks that follow.

I am firmly convinced that this Nation is now involved in an all-out struggle whose outcome will determine whether the democratic or the totalitarian concept of government will dominate in the future. We refer to this struggle as the cold war but in doing so, I believe that we are prone to occasionally forget that the real issues are ideas, basic principles and convictions, and fundamental doctrines. The more obvious conflicts that arise, for example, in debates over relative postures in economics or in science are, to me, merely the open manifestation of the basic struggle.

These manifestations are important in that they represent the milestones whereby the progress of the opposing forces in this struggle are measured—and I happen to believe that the fruits of science and technology will, in the future, be used as one of the major signposts to measure the success of these opposing ideologies. It is in this sense that the so-called "race in space" assumes major and lasting international significance.

Something over a year ago I was invited to express my views to the House Committee on Space Exploration as to what the next 10 years in space might hold. I recall that in the process of pondering this question, I could not help but explore the related question of how these predicted events might materialize, and it seemed to me that the controlling factor might well be one of will and motivation as much as that of technical competency or funding.

I believe that this same thought pertains to the situation existing today. In short, the point I am making is that we must be concerned with defining our goals and making them known, as well as being concerned with funding, manpower, and organizational matters—or in other words, we must define the ends before trying to develop the means of getting there.

Whether a definition of national goals which relate to the specifics of the struggle we are in can best be accomplished through high-level committee action or by some other mechanism, I do not feel qualified to remark on; I am sure that there are others more skilled in organizational matters than myself who could evolve proposals in this area. I will only comment in passing that I feel much more needs to be done in the direction of developing dynamic national goals than the citizenry can comprehend and are willing to support.

I believe that in the remainder of my remarks it may be of more value to the committee if I address myself directly to certain questions which the committee has indicated interest in and with which I am more conversant.

On the question of whether the present situation requires Government support of scientific and technological projects not necessarily related to military weapons objectives, my answer is unequivocally "Yes."

The civilian space program is an obvious example, and there are others which could have an equally important impact on world opinion. For example, methods of weather control, the development of fusion power, and the development of low-cost, practical power generation sources which might derive their energy from the sun or from thermoelectric devices. Devices of this latter kind should find widespread application in the underdeveloped countries of Asia and Africa, even though there is little demand for them at the present time in this country.

These and many other technological developments which could exert an important influence on the rest of the world should be supported by the Government to the extent necessary to insure that we—and not the Soviets—attain them first.

There are definitely areas where scientific and technological advances will not be made without strong Government support. Since World War II a large amount of our new technology, underlying

developments such as television and jetplanes, owes a large debt to Government-supported work carried out during the war or postwar eras. It is true that most of this support stemmed from potential military applications and it is to be expected that new technological advances will continue to fall out from military developments. I do not believe, however, that Government support should be restricted to military developments.

Important technological advances, today, are complex in nature and usually result from team efforts requiring elaborate and costly equipment. In many cases, private industry or the universities are either not in a position to fund such undertaking or lack the incentive to do so because of the long-term investment required.

The atomic energy field is a classical example of this. I would conclude, therefore, that in instances where exploitation of a scientific area may seem to hold national implications, and little activity is underway, the Government should step in and initiate undertakings through direct funding support. Once the area is self-sustaining, so to speak, I would favor curtailment of Government support.

The Government has underwritten a great deal of scientific research since the war. Generous support has been given to organizations such as NASA, the National Radio Astronomy Observatory, Brookhaven Laboratories, and so forth; however, there is need of more support of science for its own sake, rather than for some implied military or other "practical" benefit. The National Science Foundation, is, of course, a good move in this direction.

As to ways in which our Government can do a better job of assuring a long-term continuation of our country's preeminence in science and technology, I believe that the major factor is to assist in providing incentives which will encourage more of our younger generation to seek out science or engineering as a lifetime career. Advanced education, including academic research, will fill the reservoir that will be the source of technology in the decade of the 1970s. Encouragement of good students, good teachers, and good technical schools is clearly desirable.

In order to further maintain this preeminence, our scientists and engineers must be able to work in the proper technical, fiscal, and social atmosphere, and the Government should be instrumental in helping to provide this environment. It is reported that in Russia the scientists are accorded one of the highest positions in society. In this country, while the stature of the scientist has increased remarkably recently, more remains to be done to motivate interest in science and engineering as a career.

I also believe that it is possible for the Government to do a better job of identifying and prosecuting crucial technological developments. This can be done only through the Government inviting in and heeding the advice of the top scientists of the country. One can recall the very indirect approach, through Einstein to the President, that the first atomic scientists had to resort to in interesting the Government in the possibility of the atomic bomb development. No military planner could have been reasonably expected to call for the development of atomic bombs as a consequence of the Hahn and Meitner experiments in Germany in 1938, for the potential significance of this discovery was well beyond the comprehension of all but the keenest scientists.

On the other hand, the IGY space program is an example of an instance where the military, or at least the Army, took the initiative in urging that the Government support a program because of its cold war importance, while most scientists failed to see the advantages to be gained politically through this program.

The lesson here is, of course, that the effects of science and technology on the cold war and, conversely, that of the cold war on science and technology, must be openly recognized and reckoned with in high level decisionmaking. The advent of the sputniks vividly pointed this up and it should be obvious that the governmental decisionmaking process must now contend with many more factors than were evident in the presputnik era.

The optimum mechanism for obtaining high-level decisions to prosecute technical programs is difficult to precisely define. Quite obviously the Government cannot proceed with every scheme brought in by bright-eyed young scientists or by various vested interest groups, and yet, any one of these may well be of supreme national importance. The answer can only lie in establishing a definite and uncomplicated hierarchy of decisionmaking authority with competent, farseeing men at each level who have the integrity and objectivity to make decisions and the stamina to back up their decisions. Committees of scientific specialists and staff advisers may play a very useful role in gathering the facts for the decisionmakers, but the decisions should not be left to committee actions.

I believe that it is illusory thinking to expect that very many of the serious problems facing Government today can be solved by the appointment of ad hoc committees of well-intentioned citizens from private life. The important problems are generally so complex that, unless an individual is in a position to devote full time to familiarizing himself with all the factors to be considered and the implications of the various decisions that can be made, the chances are that judgment by opinion can only result.

In the case of a committee having sizable membership, the findings will usually represent the lowest common denominator of the collective opinions. While this may be pure democracy or collective thinking in action, I do not believe it is a practical substitute for decisionmaking by competent authority who can subsequently be held accountable for implementing the actions resulting from the decisions.

I do not wish to imply that there is not a useful role for committees; rather, I am making the point that we cannot expect to solve our problems by dissipating the decisionmaking process among groups who can consider them on only a part-time basis.

On the question of how our Government can do a better job of relating technological developments to our overall national strategy, I believe the answer again reverts to first having a clear concept of what our national goals are and secondly, appointing to positions of authority, competent and experienced operating officials who are dedicated to these goals and who are empowered to make decisions.

There is a need for informed and wise statesmen who are capable of analyzing the basic issues of complex technical situations. Soldier, scientist, and statesman must each understand the problems and needs of the other. Recent history holds many examples of mistakes made because this understanding failed to occur; Germany stopped develop-

ment of radar very early in the war while it was still in a primitive stage, and the United States failed to embark on a ballistic missile program at the end of the war.

Mistakes will never be completely avoided, but they will be minimized by placing the critical decisionmaking in the hands of competent people having sufficient appreciation of scientific matters and access to the best possible advice to permit them to consider all possible implications of the choices with which they are confronted.

I believe that there is no question but that we as a Nation have failed in times past to realize the world prestige implications of major scientific developments. The situation in my opinion is improving, but I have doubts whether the average layman is yet aware of the import which the world, and in particular the underdeveloped nations, will attach to significant scientific breakthroughs in the future.

I think it vital that the populace have at least a general understanding of this importance since they are called upon to pay for the cost of these developments. While my primary concern is with space activities, I cannot help but wonder what the impact on the world would be if, for example, the Russians are the first to develop a cure for cancer, or perfect a commercial transport plane flying at high supersonic speeds.

I have had little direct experience which would permit me to comment intelligently on whether or not there is sufficient rapport between the State Department and the scientific community.

On the question of the budgetary process, my own experience is that the present process whereby funds for research and development activities are authorized on a yearly basis does definitely impede scientific and technological developments. It is inherent to the nature of these activities that plans must be made for several years into the future.

At the same time, the work must be responsive to current results and must be capable of rapid reorientation. In the case of pure scientific research, it is necessary to establish an atmosphere of continuity and freedom from interference for the skilled professional scientist.

In both cases, the problem of annual justification and budget process is indeed a hindrance to technological progress. One of the most significant problems is that of obtaining proper facilities and equipment needed to conduct a program. In many cases there is a delay in obtaining test or laboratory facilities because of governmental funding practices which separate construction and equipment funds from the program funds.

I believe that this fiscal area is one which should receive the deepest consideration by the Congress with a view toward examining the practicality of authorizing funding for major research and development activities over 3- to 5-year periods, and also the practicality of allowing better facilities planning and funds to be included in program authorizations.

In conclusion, I want to reiterate that I believe our basic democratic processes are perfectly capable of maintaining our national leadership in science and technology. I would not make any major changes in our governmental organization to accomplish this end.

I believe it is essential for us as a nation to better define our national goals and to understand the part that science and technology play in both our military and our nonmilitary posture and policies.

The trend toward an increasing use of part-time committees of experts to make critical decisions should be reversed. The Government should strive for excellence in all its decisions, and, by delegating responsibility and authority through clearly defined channels, it should emphasize the role of the individual and thereby help to attract and keep some of the most competent minds in the Nation within the Government.

Senator JACKSON. Thank you, Dr. Pickering. We appreciate the time and trouble that you have gone to in preparing this statement and thinking about the problem as put to you in the series of questions we submitted.

Senator Church may have a question, and I will defer my questions for the moment.

Senator CHURCH. I just have a few questions, Mr. Chairman.

Dr. Pickering, I certainly do feel with you that public money needs to be devoted to scientific inquiry that has no particular military significance, and I will agree further that breakthroughs in fields of medicine and peaceful transportation may have much greater impact upon world opinion than the development or perfection or sophistication of purely military devices.

What I want to inquire about relates to the present procedural organization within the Government, but I have to ask one or two substantive questions in order to get at the procedural matters.

You are concerned with space and its importance to the future and I recognize that the eyes of mankind are now directed toward space and the Soviet Union gained great stature through the sputniks. That was in general opinion in the world.

Knowing what you do about space and its implications, do you believe that space should become the next arena for the arms race?

Dr. PICKERING. Well, sir, I find it difficult to visualize—excuse me if I may define terms first—when I think about space and the military, I will think about space in the sense of orbiting vehicles or traveling far out in space, and I will exclude missiles.

Senator CHURCH. I would like you to exclude missiles and I am thinking of space in the same sense.

Dr. PICKERING. I find it difficult to say at this time exactly how space will become an arena for military action. I recognize that space at the present time can be thought of as having some military significance; namely, there has been discussion about reconnaissance, and about communications, and the aid to these problems which space can present.

Beyond this, I find it difficult at this time to conceive of exactly what military significance or military actions would be taken in space. In other words, some of the more fanciful space weapons, I find very difficult to put much credence in. I recognize in saying this that we are on the threshold of the space age, and my thoughts can certainly change in the next few years.

Senator CHURCH. You would concede, I am sure, the fact—and I think that you have already conceded the point—that it is possible

with advancing space technology for some kinds of devices to be perfected that could have important military significance?

Dr. PICKERING. Yes. I was going to comment that the reason for my questioning space for military significance, is that I ask myself what is the fundamental military problem and if it is to deliver explosives to the enemy, I can surely do this without going into space. If it is to transport people and deliver them in enemy territory, I can presumably do this without going into space.

So, I ask myself, just why would I go into space to do these things?

Senator CHURCH. With respect to the question of reconnaissance, this certainly can have military significance and with respect to communications it could have some military significance. I do not know, and so I ask the question, Is it at all possible for orbiting devices to be perfected that contain nuclear warheads that can be triggered at times or at any given moment that might have advantages that the intercontinental ballistic missile which is a ground-to-ground missile with a ground-to-ground trajectory, might not have?

Dr. PICKERING. I find it difficult— or let me first say in an engineering sense, it is possible to conceive of such a system. I find it difficult to find a value in such a system. In other words, if I have the ability to launch intercontinental missiles successfully, why don't I do it that way instead of doing it the hard way, particularly when I recognize that once I have placed an object into orbit, its path through the skies is determined by the laws of gravity, and it is exactly predictable where it would go and it will only be over enemy territory a certain length of time and so on, and so I find it difficult to conceive of the practical utility of such a device.

Senator CHURCH. Let me suggest, without pursuing this much further, that there may be utility in such a device as compared to the intercontinental missile in the same sense that the Polaris missile presents advantages over fixed land bases, in that these missile bases are magnets drawing enemy fire.

Space is an area where our cities and populations would not be devastated if our nuclear weapons were orbiting rather than located in areas of large population within the continental limits of the United States. I am not trying to be argumentative, but I am trying to see whether there might not possibly be a military advantage that has yet to be ascertained with respect to weapons that have yet to be developed which would find their environment in space.

Dr. PICKERING. Well, this may be. All I say is that at the present time I find it very difficult to conceive of this. For example, supposing that I had such a satellite fortress armed with weapons which I am storing in the sky until I want to use them—and supposing that a potential enemy knows that I have it there, and you cannot avoid that.

Supposing that he shoots it out of the sky and is this an act of war? He shoots it out of the sky over his own territory, let us say. I have now lost my weapons, but do I go to war over this? In other words, I foresee all sorts of problems associated with this sort of a weapons system.

Senator CHURCH. Is it possible, in your opinion, that the future may hold devices that are manned devices in space, that the direction and speed of which are controllable by the occupants of these devices?

Dr. PICKERING. Yes, indeed.

Senator CHURCH. This would change the picture with respect to the potential military significance?

Dr. PICKERING. Yes, but we must recognize if we are going to change the speed or the direction of the devices, we must do it by using fuel or using energy of some sort. So we can presumably only do this to some limited extent. In other words, like an airplane, it will run out of fuel.

Senator CHURCH. But it is possible that such devices, if they are perfected, could have real military significance?

Dr. PICKERING. Well, they would have an ability to maneuver, and therefore, presumably, would have more flexibility. I would still be concerned as to whether they solve my fundamental problem of delivering warheads on enemy territory in any more successful fashion.

Senator JACKSON. On that point, in connection with propulsion, Project Rover, the nuclear ramjet might fall into that category, would it not?

Dr. PICKERING. That is right.

Senator JACKSON. Assuming it is workable.

Dr. PICKERING. If it is a nuclear ramjet we are talking about, it must operate within the atmosphere, which complicates things to some extent.

Senator JACKSON. Well, this is the first stage of development of a nuclear propelled rocket system.

Senator CHURCH. Now, these questions were preparatory to another question. I remember at the end of the war when the United States was the only country to have atomic weapons and we undertook what was then and has since been hailed as a great act of statesmanship, and I think it was, to present through the Baruch plan a proposal for internationalizing control of atomic energy. That proposal was rejected by the Soviet Union.

Had we been successful in establishing effective international control over all classes of atomic technology we certainly would not now be occupying the chamber of horrors that is presented by this balance of terror.

I am encouraged by what you say with respect to the possible limitations of space, as an arena for the arms race. But since it is hard to perceive what the future might hold, might it not now be wise to attempt another Baruch approach and close the door to future developments in space of a military character by establishing effective international control over the probing of space and the launching of satellites into space, of a kind that would permit the United States and the Soviet Union and other countries that have developed the technology to pursue the experimentation but which would limit the kinds of devices that are thrust into space to peaceful devices of kinds that have no military significance?

In other words, I am saying, is it now a time to exercise that degree of foresight that might permit us to shut the door before an arms race begins? We know the terrible difficulties that beset us once an arms race begins and we attempt to roll it back.

Dr. PICKERING. I think this is a very interesting suggestion, Senator. There has, of course, been, I guess the preamble to the Space Act, and I am sorry I don't remember the wording, but as I remember

the sense of it, it establishes the U.S. desire to see that peaceful development of space comes about.

If such a proposal could be effected, I think indeed this would be significant because even though one does not now see, or at least I profess not to see an urgent military necessity for space, as you point out, much may develop in the future and I may also visualize such problems for example, as what is going to happen when two or more nations land men on the moon. I would hope it was done in a peaceful fashion and not a warlike fashion.

Senator CHURCH. Thank you. That is the only question I have.

Senator JACKSON. Thank you, Senator Church.

Dr. Pickering, I was very much interested in your comments regarding the role of committees. I take it that from what you have said, you feel that committees can be useful as factfinders, but that they should not get into the decisionmaking process.

Do you not feel that we have reached a point where we may well be getting too many committees without authority to act or recommend action?

For instance, this committee made inquiry of the Department of Defense, and we found out that there are over 900 committees within the Department of Defense. We have a compilation of them here. You are in a part of the defense effort that is very important and I wonder if you could comment a little more on what happens in connection with this committee system. Does it help you or does it slow you down or what are your comments on that?

Dr. PICKERING. Well, sir, as I said in my statement I think one of the most serious problems with committees of experts is the problem where the experts are called in for 1 or 2 days, once or twice a year, or whatever it may be, and during their short period of close association with the problem, I feel they cannot understand the complexities of most of the problems that they are asked to judge.

I get concerned from that angle, that the Government needs to have within its own structure, the capability to make judgments to evaluate that situation without having to call on the experts who will come in and sit there for a few days and give their best guess.

The thing that also concerns me is that it seems to me as time has gone on, since the war, we have tended to answer many problems by forming new committees. Whenever a problem has become too complex or too confusing, there seems to be a tendency to form another committee to try to see their way through the problem.

It does not seem to me that this is facing up to the realities, and it seems to me that the whole trend is in the wrong direction. I am interested in your statement that the Department of Defense has 900 committees, and I am astonished that there are that many.

Senator JACKSON. In fairness, this has been a problem, I think, that has plagued all administrations, and I think that it is an American habit to appoint a committee, Dr. Pickering, and then we let the committee continue on. For instance, they have a Joint Master Menu Board, and there is an Interservice Flight Vehicle Power Group. Have you been working with that one?

Dr. PICKERING. No, sir.

Senator JACKSON. I would think that you would be right in that one, with all of the space problems. Then, there is the Fiscal Spon-

sors Committee of the Toxicological Information Center. Then there is the Department of Army Accelerated Item Production Program Task Group.

Then, they have an Interdepartmental Screw Thread Committee. Then there is a Helium Policy Committee. You might be interested to know that the Helium Policy Committee has the following directive:

To study national policy to prevent the loss into the atmosphere of any appreciable part of the country's helium, which has not first served the purpose of helium.

I want to say that in making this comment, Doctor, I again repeat that we are talking about the American habit of not resolving a problem, but appointing a committee and letting them resolve it. The result is that the committee meets, and then they may make some recommendations, but then they are not acted upon. Is this a fair statement?

Dr. PICKERING. I have seen that happen all too often.

Senator JACKSON. What I gather from your statement is that we need to have national goals and objectives, and we should not implement those national goals and objectives by ad hoc organizations, or ad litum, as the lawyer would say.

But I take it, it is your position that we need to have organizational structure with continuity to implement these national goals and objectives.

Dr. PICKERING. Yes, sir; that is my idea, indeed.

Senator JACKSON. And the main problem is to first of all recognize or to identify the national goals and objectives.

Dr. PICKERING. First, to identify the goals, yes; and then if you will give the people concerned the authority and the responsibility so that they know they have the authority and that their decisions will stick, then you will encourage people to make decisions without having a committee to back them up all of the time.

Senator JACKSON. You would not object to a committee if someone on the committee does really make a decision?

Dr. PICKERING. I think it would be better if the governmental person concerned would make the decision.

Senator JACKSON. But I say, as long as real decisions can be made, I understand that most of these committees—not all, and there are some where decisions can be made—but most of them meet and discuss and debate and then they walk away and no one can make a decision.

I take it, too, that you feel that science and technology are inseparable elements in a broad framework that involves the overall posture of this country in relation to potential enemies, and that we cannot separate them and deal with them on a separate basis, but that we have to recognize this broad inseparable challenge.

Dr. PICKERING. Yes, sir, and I feel that science and technology enters into practically every aspect of Government nowadays. It will to an increasing extent as times goes on, and this must be recognized.

Senator JACKSON. Do you feel that there are areas in science that, while they do not involve direct military considerations, might affect the prestige and therefore, indirectly affect the overall posture of our country?

Dr. PICKERING. I do, indeed.

Senator JACKSON. We have had dramatic proof of that, have we not, in the space program?

Dr. PICKERING. That is right.

Senator JACKSON. And despite the fact that we may be ahead in certain areas, unless our allies and our friends, including uncommitted peoples, believe it, it can hurt the prestige and, therefore, the overall posture of our country?

Dr. PICKERING. Yes, sir.

Senator JACKSON. I believe you brought that out in one of the hearings some time ago in connection with a survey of public opinion in Western Europe. This poll is in our reports. I believe it was the Gallup poll of what our allies think.

Dr. PICKERING. Yes, sir.

Senator JACKSON. And I presume that in your remarks here, you were alluding to that sort of a situation?

Dr. PICKERING. Yes, sir.

Senator JACKSON. Now, if I may turn to one other item, I was very pleased to have your comments regarding the budgetary process as it affects research and development programs. Mr. Lovett, you may recall, if you had a chance to read his testimony, made that point.

That was that research and development projects cover a period of years. He felt that there should be a funding over that period of gestation, whatever it may be, 3 to 5 to 6 years. That is essentially your judgment, also?

Dr. PICKERING. I feel the same way; yes, sir.

Senator JACKSON. And you feel that in this area a recommendation by the administration to the Congress along this line would be helpful in not only saving the Government money by avoiding ups and downs, but might reduce the leadtime on some of these projects.

Dr. PICKERING. I think if we had more stable funding, leadtime would be reduced on projects and I don't think that there is any question about that. The mechanism for obtaining that, I have no opinion on.

Senator JACKSON. I know that the point you made also has reference to the problem that scientists are up against; namely, when you are working on a research and development project you are doing the basic research and so on, and you want to get around to the construction, you are sometimes held up, are you not, because of funds not being available for construction purposes?

Dr. PICKERING. Yes, sir, and the fact that construction and equipment funding usually is handled through a different channel, or a different fashion than the programs, very frequently leads to construction and programs moving apart and facilities not being available when they are needed.

This is also, of course, complicated by the fact that facilities in general have a long leadtime to build, and if we add to that a long leadtime to obtain the funding, then there are difficulties.

Senator JACKSON. One of the big problems that we have been up against in these various races of discovery with the Soviets has been leadtime, is it not?

Dr. PICKERING. It has, indeed.

Senator JACKSON. And your point, I take it, is that by funding these projects over the period of the research and development effort,

you would help to speed up the development period and, therefore, make it possible for us to do a better competitive job.

Dr. PICKERING. I think so.

Senator JACKSON. Now, I have one last question: You indicated in response to one of your questions that you have not had any direct experience that would permit you to comment intelligently on whether or not there is sufficient rapport between the State Department and scientific communities. I wonder if you feel that it is important for the Department of Defense, especially in the area of research and development, to work closely and to keep the State Department currently informed on what they are doing, particularly as to new projects that might have an impact on our prestige and standing in the world, as well as the items that are of purely military nature.

Dr. PICKERING. Yes, sir, I do, indeed; in fact, I would hope that this occurs but if it does not, I would certainly feel that it is most important. As a specific example, at the present time, looking at our space program, since we are flying things which go all over the world, and fly over many countries, it would seem to me that the nature of any military space program which may be undertaken should be a matter of concern to the State Department.

Senator JACKSON. I was particularly interested, Dr. Pickering, in your comment that the IGY space program was an example of an instance where the military, or at least the Army, took the initiative in urging that the Government support a program because of its cold war importance, while most scientists failed to see the advantage to be gained politically through this program.

Dr. PICKERING. Yes, sir.

Senator JACKSON. I think that this statement points up the need for getting the points of view from the military and from the people in the State Department and from the scientists, so that they are brought up to the summit where the critical undertakings can be identified and decisions made, does it not?

Dr. PICKERING. Yes, indeed.

Senator JACKSON. And as a scientist and an engineer, you would not want to say that scientists and engineers should make the overall decisions in this important area.

Dr. PICKERING. No, sir. We should have an input, but certainly, there are many other factors which must determine decisions.

Senator JACKSON. But the statesmen of today must be truly informed about the importance of science and technology and when he receives the information he must be able to identify its importance in relation to our national security and our national overall position?

Dr. PICKERING. Yes, sir. I feel that it is important for statesmen to have knowledge of science, obviously not to be experts in science but to have knowledge of science—as I have said one time, to be able to distinguish between the realities and the science fiction.

Senator JACKSON. I think that is an excellent statement.

Dr. Perkins made the point yesterday, if I may paraphrase what he said, that the effective role of the scientist and the technologist is to advise the proper leaders in Government as to their particular undertaking, its impact, and its importance from their point of view. With the facts, then the political leader must make the proper decision; is that a true statement?

Dr. PICKERING. I think so; yes.

Senator JACKSON. And it would be a mistake for the scientist to get into the policymaking business as such, at the top level.

Dr. PICKERING. Didn't H. G. Wells do that once?

Senator JACKSON. It is very well said. I want to thank you for those fine comments.

Mr. PENDLETON. Doctor, I have before me a chart called satellite situation report from the Aviation Week and Space Technology of April 11. This chart shows that 14 American and two Soviet satellites are still in orbit in outer space from the original ones since 1957. If there is no objection, I would like to have that inserted in the record, the chart and the article.

Senator JACKSON. It will be included in the record at this point. (The material referred to follows:)

[From Aviation Week and Space Technology, Apr. 11, 1960]

SPACE PROGRAM TURNS A CORNER

By Robert Hotz

The successful operations of the Pioneer V deep space probe and the Tiros weather-eye satellite during the past few weeks may indicate a significant upturn for the U.S. space program as currently operated by the National Aeronautics and Space Administration. Both of these space shots were executed with technical precision that placed their payloads in their anticipated positions in space. Both payloads have been functioning with a high degree of reliability and returning a significant amount of useful scientific data to earth. The almost perfect circular orbit of Tiros is another major advance.

These successful space ventures are also significant because they prove a point many people made in the early days of the sputnik era. This was that this country has the technical capability to mount a scientifically significant and internationally useful space exploration program and that the only essential ingredient lacking was national leadership and organization.

All of the hardware utilized in both Pioneer V and Tiros came from groups long established in the aerospace industry: Radio Corp. of America, Space Technology Laboratories, Douglas Aircraft, North American Aviation, Aerojet, Hercules Powder Co., and several universities. Launchings were handled by the USAF Ballistic Missile Division which has managed the ballistic missile program so expeditiously. NASA, of course, served as the overall systems manager for both of these projects.

There are some notable differences between Pioneer V and Tiros, on the one hand, and the Soviet lunar ventures of last fall. The Soviets have still not furnished much useful scientific data from these lunar ventures despite the successful execution of both the impact and satellite missions. Nor have the Soviets, for all their lip service to scientific interchange, made much tangible contribution to this cause. This may be because the data returned from their impressive list of successful space vehicles is meager and they might be internationally embarrassed by this exposure or it may be simply another manifestation of the centuries-old Russian passion for secrecy in conflict with its modern environment.

However, both Pioneer V and Tiros are already firmly established by their performance in space as scientifically useful ventures. This significance is expanding with each passing day of their performance. Pioneer V, among other things, has proved the feasibility of long-range communications in outer space and has given a remarkable demonstration of the reliable use of solar energy in this area. Tiros, providing its global cloud cover strips, certainly must have an impact on some of the early skeptics who refused to believe that anything really useful to man on earth could come from this space nonsense. Tiros is the first of the initial generation of useful satellite programs whose benefit will soon be available.

On the basis of the data made available by Pioneer NASA on its variety of space programs, particularly Pioneer V and Tiros, compared with what the Soviets have made public on their efforts, it appears that we have begun to

produce more scientifically useful space efforts than the Soviets, although it will be a long time before the international propaganda luster is worn from their initial successes.

It would be a mistake to conclude that Pioneer V and Tiros, have in themselves won the space race with the Soviets and that we can now relax and coast along comfortably. It is obvious that the Soviets have more tricks to pull from their space bag. With the decay of Sputnik III it is not likely that they will leave space bare of devices bearing the "CCCP" label of their Cyrillic alphabet. It takes no special crystal ball to predict that the next Soviet space efforts will be timed to obtain maximum political effect from the summit meetings in May and President Eisenhower's visit to the U.S.S.R. in June.

Thus far, the Soviet space scientists have loftily rejected U.S. proposals to establish an International Academy of Space Sciences (AW Mar. 28, p. 25) as premature. This attitude is apparently stimulated by the Soviet feeling that they are the primary fount of space science, and little contributions are available now from other countries. Dr. Theodore von Karmon, one of the authors of the international proposal, has wisely observed that this Soviet intransigence is likely to melt once we have a few successes. It will be interesting to watch the Soviet attitude toward the International Academy proposal as a possible barometer of their own space technology and an indication of when they feel they may have something to gain from an international scientific exchange.

One other aspect of the Soviet space program, in contrast with our own, that emerges with the passing of time is the surprising lack of depth and scope to their effort. They have conducted no satellite launchings since Sputnik III on May 15, 1958. In the interval, they have mounted only three lunar missions. This is ample for an international propaganda program but can hardly fill the requirements of a serious space exploration program.

In contrast, both the NASA and USAF space programs are now moving on an extremely broad front covering the entire spectrum of immediately feasible space exploration projects and aimed at providing immediately useful results from space such as long-range communications, reconnaissance, weather information, and precise navigation fixes.

Thus, as we pass the halfway mark of the third year of the space era, we can see some significant changes developing in our position versus that of the Soviets.

There is general agreement that NASA has developed a sound 10-year program for the scientific exploration of space and the military services keenly appreciate the potential of space systems to deter aggression and blunt the edge of enemy surprise.

The problem now is to stick to the objectives detailed in the NASA program and to push their achievement with the full budgeting and technical support they require.

We are certainly in a bitter international contest with the U.S.S.R. for the minds of men, and space is an important sector in that battle. But, regardless of this important aspect of our space program, there are many other valid reasons for pressing on at a maximum technical pace to reap for ourselves and the rest of mankind the immediate benefits available in space and to provide more knowledge of the universe around us that is the truly distinguishing mark of man himself.

Satellite situation report

	Code name	Source	Launch	Status	Period, minutes	Statute miles	
						Apogee	Perigee
Satellite:							
Alpha 1	Rocket body	U.S.S.R.	Oct. 4, 1957	Down Dec. 1, 1957			
Alpha 2	Sputnick 1	do	do	Down early January 1958			
Beta	Sputnick 2	do	Nov. 3, 1957	Down Apr. 14, 1958			
Alpha	Explorer 1	United States	Jan. 31, 1958	In orbit	108.6	1,232	216
Beta 1	Rocket body	do	Mar. 17, 1958	do	138.2	2,683	402
Beta 2	Vanguard 1	do	do	do	133.8	2,445	401
Gamma	Explorer 3	do	Mar. 26, 1958	Down June 28, 1958			
Delta 1	Rocket body	U.S.S.R.	May 15, 1958	Down Dec. 3, 1958			
Delta 2	Sputnik 3	do	do	Down Apr. 6, 1960	89.7	238	105
Epsilon	Explorer 4	United States	July 26, 1958	Down Oct. 23, 1959			
Zeta	Atlas	do	Dec. 18, 1958	Down Jan. 21, 1959			
Alpha 1	Vanguard 2	do	Feb. 17, 1959	In orbit	125.0	2,049	347
Alpha 2	Rocket body	do	do	do	129.6	2,279	347
Beta	Discoverer 1	do	Feb. 28, 1959	Down early March 1959			
Gamma	Discoverer 2	do	Apr. 13, 1959	Down Apr. 26, 1959			
Delta	Explorer 6	do	Aug. 7, 1959	In orbit	686.2	23,980	117
Epsilon 1	Discoverer 5	do	Aug. 13, 1959	Down Sept. 28, 1959			
Epsilon 2	Capsule	do	do	In orbit	103.2	1,004	121
Zeta	Discoverer 6	do	Aug. 19, 1959	Down Oct. 20, 1959			
Eta	Vanguard 3	do	Sept. 18, 1959	In orbit	130.0	2,322	315
Iota 1	Explorer 7	do	Oct. 13, 1959	do	101.2	671	345
Iota 2	Rocket body	do	do	do	101.1	670	343
Kappa	Discoverer 7	do	Nov. 7, 1959	Down Nov. 26, 1959			
Lambda	Discoverer 8	do	Nov. 20, 1959	Down Mar. 8, 1960			
Tiros 1		do	Apr. 1, 1960	Orbiting earth	99.15	468	435
Transit 1		do	Apr. 13, 1960	do	94		
Lunar and space probes:							
Lunik 1	Mechta	U.S.S.R.	Jan. 2, 1959	Orbiting sun			
Pioneer 4		United States	Mar. 3, 1959	do			
Lunik 2		U.S.S.R.	Sept. 12, 1959	Hit moon, Sept. 13, 1959			
Lunik 3	59 Theta	do	Oct. 4, 1959	Orbiting earth			
Pioneer 5		United States	Mar. 11, 1960	Orbiting sun			

Mr. PENDLETON. In your opinion, what is the effect of the launching of Pioneer V, Tyros, and Transit as a part of our space program? Do you think that that is a substantial achievement of the scientific community of the United States?

Dr. PICKERING. Yes, sir; I think it is a very encouraging thing to have seen these three successes in quick order. I think it is indicative of the fact that here in the United States we are establishing a firm space program which is beginning to pay off.

After the initial hysteria associated with the space program, we settled down and we are getting our program going, and we are hopefully expecting to see a continuing series of scientific achievements of this sort.

I would also like to comment that as a whole, if we look at the scientific achievements of the United States and the Soviets in this area of space, I think we must agree that American scientific achievements at least equal the Soviet scientific achievements.

Mr. PENDLETON. As far as our allies abroad are concerned, do you think that the launching of those three satellites had any effect on their opinion of our world position?

Dr. PICKERING. I would hope so. I think that particularly about the Pioneer V, and the Tyros; that should have the appropriate dramatic impact on our friends elsewhere in the world.

Mr. PENDLETON. I have before me a series of clippings from Western European press after the date of Pioneer V, but prior to the time of Tyros and Transit I, which I think you might be interested in. The first one is from the London News Chronicle of March 12:

> The package of instruments, most compact and complex ever designed, is a real triumph for American technology. For rocketry and instruments, Pioneer V ranks with Russia's Lunik III, which photographed the unseen side of the moon.

In Denmark, and I will not try to pronounce the name of the newspaper, on March 12:

> With the successful launching of the satellite Pioneer V yesterday, the Americans accomplished the world's most important space experiment so far and gained considerably upon the Soviet Union in the space race. The American experiment will have greater meaning for science than the Russian moon shot, and it is the real forerunner of space travel.

In France, there is a newspaper account of that, on March 16:

> The Americans can give the Russians change for their coin (meaning give better than they receive) with the remarkably successful launching of Pioneer V.

There are other comments here from Germany, Italy, and Norway and Sweden. So I think that is rather encouraging on what our allies are thinking toward us, in view of the earlier blow that we received.

Dr. PICKERING. Yes, indeed.

Mr. PENDLETON. Mr. Chairman, with your permission, I would like to have you look at those, and without objection, I would like to have them inserted.

Senator JACKSON. We will insert those.

(The newspaper comments follow:)

SELECT QUOTATIONS FROM THE WEST EUROPEAN PRESS CONCERNING THE U.S.-U.S.S.R. OUTER SPACE RACE AFTER PIONEER V LAUNCHING

Britain

"This is America's second successful [solar] space launching to brighten a long list of frustrating failures—and it represents a new challenge to the Russians."—London's Daily Express, March 12, 1960.

"The value of information will be much increased if its [Pioneer V] ambitious arrangements for the storage of information and its transmission back to earth are successful. This will be as important an innovation in its way as the Russian technique of developing negatives in flight and later transmitting them slowly by radio."—The Times, London, March 12, 1960.

"The package of instruments—the most compact and complex ever designed—is a real triumph for American technology. And for rocketry and instruments Pioneer V ranks with Russia's Lunik III, which photographed the unseen side of the moon."—News Chronical, London, March 12, 1960.

Denmark

"With the successful launching of the satellite Pioneer V yesterday, the Americans accomplished the world's most important space experiment so far and gained considerably upon the Soviet Union in the space race. The American experiment will have greater meaning for science [than the Russian moon-shot] and is the real forerunner of space travel."—Berlingske Tidende, Copenhagen, March 12, 1960.

"It would be wrong to consider this event as an American attempt to overcome an inferiority complex and an experiment to match the Soviet triumph in the skies. First and foremost, the experiment serves scientific purposes. The American scientists have with this satellite provided a fairly clear picture of conditions in space."—Information, Copenhagen, March 12–13, 1960.

France

"The Americans can give the Russians change for their coin [give better than received] with the remarkably successful launching of Pioneer V."—Parisien Libere, Paris, March 16, 1960.

"Pioneer V will probe the unknown regions of the sky. It will speak to the earth from a distance of 80 million kilometers while Lunik I went dead at 600,000 kilometers."—France-Soir, Paris, March 13–14, 1960.

"American scientists can rejoice at the success of this launching."—L'Aurore, Paris, March 15, 1960.

"Lunik I has not done this [radioing back from the apogee]. It was silent. Pioneer V will bring us information of the highest importance."—Combat, Paris, March 16, 1960.

Germany (West)

"After a series of Soviet triumphs and a chain of discouraging [U.S.] failures, the successful launching of Pioneer V is a ray of hope not only for the U.S. but for the entire West."—Die Welt, Hamburg, March 14, 1960.

"It is a fact that the Soviet moonshot yielded, at best, a hundredth of the scientific data the new U.S. space probe is capable of transmitting . . . back to Earth."—Muenchener Merkur, Munich, March 14, 1960.

"Although Pioneer V weighs only one-ninth as much as Lunik I its significance in space exploration is much greater."—Der Mittag, Duesseldorf, March 14, 1960.

"Of the three artificial planets in orbit around the sun, two are American-made. . . . American satisfaction is natural at a time when national prestige is dependent on launching moon rockets and sun planets."—Frankfurter Rundschau, Frankfurt, March 14, 1960.

Italy

"Today's success helps to restore, at least in part, the prestige of American science and technology after last year's spectacular Soviet experiments."—Il Messagero, Rome, March 12, 1960.

"While Pioneer V cannot be compared to Soviet ballistic successes, it is nevertheless the first 'planet' capable of transmitting scientific information to Earth. . . . Lunik I entered a solar orbit by error and was not equipped to send back information."—La Stampa, Turin, March 13, 1960.

"The successful launching [of Pioneer V] is a tonic for the U.S. in the Russo-American space race and confirms that although the U.S. got a late start, it is very rapidly regaining lost ground."—Corriere della Sera, Milan, March 13, 1960.

Norway

"It is certainly the greatest distance of space control by radio signal. The distance from the earth of the Soviet Lunik III was around 100,000 kilometers less. The successful launching of Pioneer V is truly a forerunner of a new American scientific attempt to send a rocket to the moon within the next six months."—Arbeiderbladet, Oslo, March 14, 1960.

Sweden

"Pioneer V opens a new epoch in space experiment."—Dagens Nyheter, Stockholm, March 12, 1960.

Mr. PENDLETON. In your statement, you say:

I feel much more needs to be done in the direction of developing dynamic national goals that the citizenry can comprehend and are willing to support.

Do you have any suggestions as to what could be done in the development of these goals?

Dr. PICKERING. No, sir. But the point I was really trying to make was that to be significant, goals must be understood and accepted by the citizens and by the people of the country. I feel, for example, that in this past year or two, people in the country in general have not really understood our space program.

I believe this is improving now but it has taken time for people to understand it, and I am using that as a thought. It seemed to me that it is indicative of the fact that any time we do establish significant goals, they must be sold to the people or the people must agree with them.

I was making that point rather than making any point of the mechanism about how to establish those goals.

Mr. PENDLETON. On the last page of your statement, you refer to an increasing use of part-time committees of experts to make critical decisions. Later on you discussed these people who are brought in for 1 or 2 days a year. Could you give an example of such a decision-making committee? Either currently or in the past?

Dr. PICKERING. I would take, for example, the committee which made the initial IGY decisions or the initial Vanguard decision for the IGY space program. That was a committee of this type which was evaluating the possibilities as to whether the United States should embark on a space program or scientific satellite program as to how it should be done.

They were evaluating in effect, proposals made by the Armed Forces and selected the Vanguard proposal as the one to initiate.

Mr. PENDLETON. Now, was the result of their activity a recommendation to the Secretary of Defense, or what came out of that meeting?

Dr. PICKERING. The result of their activity was indeed a recommendation to conduct this particular program. I am sorry. I do not remember who the committee was reporting to.

Mr. PENDLETON. The only point I was trying to make is that they made a recommendation to the Secretary of Defense, didn't they?

Dr. PICKERING. Oh, yes. The actual formal decision was made within the Government.

Mr. PENDLETON. A Government official made the decision?

Dr. PICKERING. That is right.

Mr. PENDLETON. Finally, you referred to the problem of funding in the scientific field and the delay in construction of various activities from the lack of funds because of separation between construction and the research field.

Dr. PICKERING. Yes, sir.

Mr. PENDLETON. I was wondering whether you were acquainted with the recent decision on the reactor program. Let me read the clipping. This is the New York Times, Tuesday, April 12:

> Democrats on the Joint Congressional Committee on Atomic Energy killed today, for the second consecutive year, the administration's high-priority plan to build a new type of atom-smasher at Stanford University.
>
> The effect of the committee's action, Atomic Energy Commission officials said, could delay by more than a year completion of the machine. President Eisenhower's scientific advisers have said it was of vital importance in maintaining United States leadership in nuclear research.

Are you aware of that decision to cancel the funds for that project?

Dr. PICKERING. Yes. I remember the newspaper story now. I have had no personal contact with the project.

Mr. PENDLETON. Is that the kind of thing that you are referring to when you refer to delay of construction through lack of funds?

Dr. PICKERING. Yes.

Senator JACKSON. I want to call to the minority counsel's attention the fact that $3 million was provided for planning, and I don't think that his statement is complete, nor do I think it is relevant to the question of long lead funding.

I merely make that point clear, and I would also like to call to his attention that even the Atomic Energy Commission which is a part of this administration, had serious questions about this project. So just reading something into the record does not make it a fact from an article in a paper and a very reputable paper. I just want to make that clear.

I served on the Joint Committee, and I am now serving on it and I also want to state that the committee received so many different recommendations as to what the capital cost was going to be, and what the operating costs were going to be, that the committee felt that the sensible thing to do was to do the engineering and the design and planning in order to find out what the costs were going to be.

Actually, there is no delay in the project and it is not fair to say that the project was killed.

Mr. PENDLETON. I apologize. I intended to give you the whole article since my opinion on the facts might be subject to question. With your permission, without objection, I will submit the article for the record.

Senator JACKSON. I thought it should be read into the record; since you read the first part of it, you should read the last part of it.

The whole article will be inserted into the record.

(The article referred to follows:)

[The New York Times, Tuesday, Apr. 12, 1960]

CONGRESS GROUP BARS BIG REACTOR—ATOMIC ENERGY COMMITTEE REBUFFS ADMINISTRATION ON STANFORD PROJECT

By John W. Finney

Special to the New York Times

WASHINGTON, April 11.—Democrats on the Joint Congressional Committee on Atomic Energy killed today, for the second consecutive year, the Administration's high-priority plan to build a new type of atom-smasher at Stanford University.

The effect of the committee's action, Atomic Energy Commission officials said, could delay by more than a year completion of the machine. President Eisenhower's scientific advisers have said it was of "vital importance" in maintaining United States leadership in nuclear research.

By a vote of 10 to 6, which followed closely on party lines, the committee denied the $107,000,000 authorization reqested by the committee for construction of the 2-mile-long linear accelerator on the university's campus.

Committee Democrats said that more time was needed to study the project because of the unexpectedly high costs encountered on other atom-smashers.

However, some committee Republicans said that the Stanford project was being used as a political pawn in a longstanding fight over construction of a large atomic power plant in the Northwest.

As interpreted by these Republicans, the committee Democrats were postponing approval of the Stanford project until the Administration agreed to modify a plutonium producing reactor now being built at Hanford, Wash., so that it would also generate electricity. The conversion of the reactor into a plant producing 700,000 kilowatts of electricity for the Federally owned Bonneville Power Administration would cost about the same as the Stanford accelerator.

It was only after considerable committee pressure that the Administration in 1958 finally agreed to the construction of the Hanford reactor to meet the military's requirements for plutonium for weapons. Thus far, however, the Administration has resisted the suggestions of committee Democrats that the reactor be turned into a dual-purpose plant.

Considerable importance has been placed on the electron accelerator by the President's Science Advisory Committee because it would permit the study of nuclear particles that cannot be created in the proton accelerators now in operation or under construction. In its original version, the machine would accelerate electrons as atomic bullets to energies of from ten to twenty BEV (billion electron volts), with the possibility of later increasing the energy range to forty-five BEV.

The committee's action at this time is in marked contrast with the official position it has taken strongly endorsing a vigorous and expanded program of basic research by the Atomic Energy Commission. Republican members are expected to refer to this past position of the committee in a minority report they are drafting on the Stanford project.

The committee did approve $3,000,000 for preliminary engineering design work on the Stanford machine with the prospect that the construction funds might be authorized next year.

Mr. PENDLETON. I have no further questions.

Senator JACKSON. Do you think the Soviet or the United States have made the best use in space in support of our foreign policy and national prestige up to now?

Dr. PICKERING. Well, sir, it seems to me that the Soviets with their sputniks have been much more dramatic in space and have conducted a program apparently, which was aimed very deliberately at its propaganda value.

Senator JACKSON. As a matter of fact, Mr. Khrushchev has shown a rather unique genius for timing his exploits with certain foreign policy objectives; is that not true?

Dr. PICKERING. Yes, sir; and I wonder what will happen in space between now and the summit meeting.

Senator JACKSON. That was my next question, and I was going to ask whether you thought it not entirely impossible that they might make some dramatic move in space prior to the summit meeting.

Dr. PICKERING. It has been quite a while since they have had a space shot, and I would not be too surprised if one was conducted in the next few weeks.

Senator JACKSON. You are suggesting there may be some precedents for this, such as Mr. Khrushchev's device hitting the moon 2 days prior to his landing in Washington.

Dr. PICKERING. Yes, sir.

Senator JACKSON. And on his return their orbiting of the moon and taking a picture of the backside.

Dr. PICKERING. Yes, sir.

Senator JACKSON. So that as far as the Soviets are concerned, they have seen fit in a rather effective way to measure their space programs with foreign policy objectives.

Dr. PICKERING. Yes, sir. It appears to me to be so. Let me say that I feel that having, as it were, gone through this first couple of years or so, where the first really dramatic effects of the space program have indeed been effectively used by the Soviets, now if we take a longer term view and we look at what the United States is doing in developing a growing and important space program, I think that we may very well find that as it were, the first really dramatic part is over now and from now on the more solid program of the United States will gradually become of increasing importance.

Senator JACKSON. Would it be fair to say that we certainly have the capacity and capability right now of being ahead in more sophisticated systems provided we get them up, to do some constructive scientific jobs?

Dr. PICKERING. I would say that to date, we have done more useful science than the Soviets have done, and as we put into space more complex systems, I expect that we will be able to do more elaborate scientific establishments in the future.

Senator JACKSON. You feel that we are in a space race, Dr. Pickering, that is vital to the security of the country?

Dr. PICKERING. Yes, sir. I feel it is indeed, because in the first place, the ability to launch successfully these large space devices is a very dramatic demonstration of your ability in military rockets. That is the first point.

Therefore, we could not possibly just sit back and let the Russians do all of this. Once having started with a space program, which we had to do, then it seems to me that we are clearly in a race with them. As far as the rest of the world is concerned, they have always looked, not always but for many years, have looked to the United States as being the technological leader, and here in this very advanced field of technology, it is clear to me that we must do our best to exceed the achievements of the Soviets.

Senator JACKSON. In other words, part of our big problem is that we have been known the world over as foremost in the field of science and technology and industrial capacity, and that to slip in this field could have damaging effect.

Dr. PICKERING. I think so.

Senator JACKSON. On our overall standing in the family of nations, you mean?

Dr. PICKERING. Yes.

Senator JACKSON. Dr. Pickering, if there are no further questions, once again I want to express to you, as I did to your colleagues that have testified here during the course of these hearings, our appreciation for taking time out to provide some answers to some very difficult questions.

I know that your testimony will be helpful in trying to bring about some constructive improvements in this area.

Now, this afternoon our witness will be Dr. Ruben F. Mettler, executive vice president of Space Technology Laboratories, in Los Angeles, and I believe the company is the technical manager for Thor, Atlas, Titan, Minuteman, and other systems. So we will resume at 2 p.m. to hear Dr. Mettler.

Thank you again, Dr. Pickering.

Tomorrow's schedule, by the way, there is some revision and I might just mention this, the first witness in the morning will be Dr. Eugene Wigner, who is Professor of Mathematical Physics at Princeton University, and the second witness will be Dr. Edward M. Purcell, Professor of Physics at Harvard University and a Nobel Prize winner, and the third witness in the afternoon, will be Dr. Herbert F. York, Director of Defense Research and Engineering of the Department of Defense.

(Whereupon, at 12:45 p.m., the hearing was recessed to reconvene at 2 p.m., on the same day.)

AFTER RECESS

The subcommittee reconvened at 2 p.m., Senator Henry M. Jackson (chairman of the subcommittee) presiding.

Senator JACKSON. The subcommittee will come to order.

We resume this afternoon and have as our witness Dr. Ruben F. Mettler, executive vice president of the Space Technology Laboratories, Los Angeles, Calif.

Space Technology Laboratories is a private company which has a system engineering and technical direction responsibility for Thor, Atlas, Titan, and Minuteman, and the communication satellite. It has also designed and fabricated, I believe, Explorer VI and Pioneer V, and had the launch vehicle responsibility for the recent Tiros and Transit satellites.

Dr. Mettler received his Ph. D. from California Institute of Technology in electrical and aeronautical engineering. He has served as a special consultant to the Assistant Secretary of Defense for Research and Development, and as a member of a special committee, Air Force Science Advisory Board.

He received the 1954 Eta Kappa Nu award as the Nation's most outstanding young electrical engineer, and was selected as one of the Ten Outstanding Young Men of America by the Junior Chamber of Commerce in 1955.

Dr. Mettler, I believe you have a prepared statement. You may proceed in your own way.

STATEMENT OF DR. RUBEN F. METTLER, EXECUTIVE VICE PRESIDENT, SPACE TECHNOLOGY LABORATORIES, INC., LOS ANGELES, CALIF.

Dr. METTLER. Mr. Chairman and gentlemen, I am convinced of the importance of your study of the effectiveness of existing Government organization and procedures for formulating and executing national security policy.

I, therefore, welcome this opportunity to appear before you. Your study gives additional assurance that the democratic process can renew and revitalize itself and can adjust the decision making machinery of Government to meet the changing requirements of national security in the face of rapid technological change, international conflict, and unusual potential for the common good or for common disaster.

You have asked me for my views with particular reference to the role and impact of science and technology on Government organization and on the formulation and execution of national security policy. I feel it necessary at the outset to define the limits of my experience and competence in this subject.

I have not held a policy position in Government, and have, therefore, not experienced at firsthand the problems of formulating policy in and with the existing organizational machinery.

Whatever contribution I may be able to make to your study derives from my engineering and management experience in private industry, in research and development of military weapon systems generally, and during the past 5 years in the planning, engineering, producing, and testing of large ballistic missile and space-vehicle systems.

Within this context, I wish to comment briefly on three general topics: the process of formulating and selecting long-range national security objectives and programs; the making of decisions to start or stop the flow of major resources to large national security programs; and shortening the development-production-operational-deployment cycle for large systems; and then I would like to close with some direct remarks concerning Government organization and procedures. I am painfully aware of the fact that all of these topics are rich in opportunity for speculation and, therefore, also rich in opportunity for error.

FORMULATING LONG-RANGE PROGRAMS

In general terms, the planning and formulation of long-range national security programs must include the development of a clear statement of integrated functional objectives, the identification of specific programs aimed at meeting the stated functional objectives, and the selection of the initial concepts for the implementation of each of the specific programs.

Clearly, planning and program formulation generally must be accomplished at several levels in the Government, in most general form at the top, and with narrowing scope and increasing detail at each intermediate level down to operating organizations.

Thus must each subelement of the planning process—statement of functional objectives, identification of programs, and selection of implementing concepts—also be accomplished in most general form at the top, and in detail at the operating level, with emphasis at each

intermediate organizational level on integration of interlocking objectives and programs, and with rapid vertical communication between levels.

To illustrate several specific points in the process of formulating long-range programs, I would like to consider the development of large ballistic missiles and the initial exploration of space as a case history, and examine the problem of selecting those space programs deserving of major national emphasis.

By the way of background, the United States has made impressive strides during the past 5 years in the development of ballistic missiles and in the initial exploration of space. The technical complexity of missile and space technology has been matched by the administrative and management problems associated with legislating, planning, organizing, funding, and contracting for radically new activities of immense scope in a short period of time.

Initially there was no reservoir of public understanding of the scientific or military or prestige value of accomplishing various particular space flight projects. Yet, space technology was obviously a field in which major projects would become increasingly large and complex and expensive and would increasingly tend to take on the character of national and even global undertakings.

To further complicate matters, a rapidly multiplying number of alternative projects became technically feasible.

With limited economic and intellectual resources, it was—and still is—very important to distinguish between what is *possible* and what is *needed*, between what *could* be done and what *should* be done. The selection of space programs deserving of major emphasis is thus seen as reasonably typical of the problem of national program formulation generally.

In tackling a problem of this type, I believe we need to start our thought process not with the fact that a certain program being considered is or is not a space program, or an underwater program, or a land program, but rather with the functional objective to be accomplished, such as strategic reconnaissance, or air defense, or reliable global military communications, or scientific research, or enhancing our prestige with uncommitted nations.

To take the objective of reliable global communications for example, it should not matter whether messages are passed out to satellites and back to earth to allow communication between two points, or whether messages are passed along an underground or underwater cable between the same two points.

What matters in this problem is how well, how economically, how reliably the functional communications objectives can be met by various approaches.

The military space program when undertaken should be a competitively superior way of accomplishing a functional military objective. Likewise, in examining an objective of enhancing our prestige with many areas of the world, sending up a very heavy satellite into orbit around the earth will certainly contribute to this objective, but so would development of a cheap source of fresh water from sea water to be used in irrigating potentially productive land.

One hears much general public discussion and debate of whether the "military space" appropriations are too large or too small. In

my opinion, that is the wrong question in most contexts. We should instead address ourselves to whether the public appropriations are too large or too small, as examples, for military warning and reconnaissance, or for realistic and reliable arms inspection, or for scientific exploration of space in its own right, or for assisting the economic development of backward nations, or for generally stimulating the development of medicine or science and technology generally, or for promoting an understanding of our political philosophy aboard.

I believe that forcing ourselves to consider space programs competitively with other ways of accomplishing the same functional objectives will still lead to the conclusion that space programs can contribute sufficiently to national security, scientific progress, international prestige, and to the national economy to warrant a large and expanding program in space system development.

The key word is "contribute." Space programs are very important, but they only "contribute." The space age is surely not exclusively an age of space. In my opinion, arriving at an assessment of the level of effort for space programs starting from functional objectives will help select the right programs and will in itself assist in building the broad perspective needed for continuing correct judgment in these matters.

The identification of particular national security programs worthy of major emphasis is enormously complicated by the crucial importance of being first with superior military systems. A difficult compromise is required between the level of performance needed to insure that the system when developed at great cost will not be obsolete, and the necessity for the shortest possible development cycle.

This requires both a prediction of the rate of future technical development and a prediction of future operational value, each balanced against schedules and total development and operating costs.

The future possibilities which depend only on continued engineering, based on scientific principles which are known at the outset, and which are therefore relatively predictable, must be carefully distinguished from those future possibilities which would require really new inventions or new scientific discoveries, and are therefore relatively unpredictable and might drastically delay the schedule for a major program.

On the other hand, it is of course critically important to recognize the possible application and importance of new ideas and/or new scientific discoveries with the least possible time lag.

Needless to say, these judgments require a high order of understanding inside the Government of both science and technology along with many other disciplines. Surely we need a good deal of uncommon along with common sense in our policy-level decision makers.

Before leaving the planning process I would like to make an observation concerning the pattern of long-range planning and program formulation during the past 50 years. I believe it is true that our policy planning has frequently suffered because at any given point in time too much progress was expected in the short run, say 3 to 5 years, and too little progress was anticipated in the longer run, say 15 to 25 years.

Short-term development progress is frequently limited by such factors as temporary engineering difficulties, changes in personnel, shifts in public interest, and natural interferences. Longer term develop-

ment progress more nearly reflects the onrushing sweep of general scientific and technological development, and is occasionally given a quantum jump by unanticipated scientific discoveries, or by the belated recognition of the application of earlier discoveries.

This pattern of overestimating and underestimating appears to characterize such developments as the airplane, electronics, jet engines, nuclear reactors, rocket propulsion, or automation, which have had a strong impact on our national security posture during the past half century.

I would suggest that a detailed and objective historical examination of the actual course of technological developments of national scope as compared with the generally predicted course during each 5 years of the past 50 years might provide valuable insight for policymakers.

MAKING DECISIONS TO START OR STOP MAJOR PROGRAMS

Long-range policy formulation is given substance in part by decisions to start or to stop the flow of major resources to individual programs. I would like to make a few brief comments on the problem of making such decisions. Inevitably, when considering national security programs, a decision to start or to stop a major program must include a number of smaller judgments in the field of science and technology.

Consider the situation of a typical Government executive at policy level. Assume that he is clear on the scope and purpose of the segment of the Government organization that he is responsible for, and clear on the scope of his own authority.

The problem is more complex if he is only half clear on these matters. He is asked to make a decision to start or to stop a major program. He is confronted with conflicting claims, alternate approaches, perhaps some personal doubt of the importance of some part of the objective, signs of real or expected technical difficulties, rising cost estimates, or partisan public appeals. He knows that rapid decisions are important.

But several billion dollars and a good deal of national security may be involved, and the penalty for error is high. In these circumstances, the speed of decisionmaking is clearly tied to the personal self-confidence of the individual Government executive at policy level responsible for the decision, together with the self-confidence of his immediate associates with policy responsibilities.

If the decision requires an evaluation and understanding of complex scientific or technical questions, then I suggest that rapid and generally correct decisions require that either the senior executive involved or at least one of his immediate line associates have extensive experience and training in the planning and execution of large and complex technologically dominated activities.

Unless there are enough executives in full-time policy positions inside the Government at all levels with such experience, there must generally be time-consuming reviews by outside technical committees, or lengthy consultation with coordinate agencies, or the painful and time-consuming process of education, all of which contribute to delays in clear decisions.

Of course, the same general point applies to the importance in rapid decisionmaking of having legal or financial talent in responsible policy positions in Government where major decisions turn on legal or financial questions.

I do not suggest that we overemphasize the point and have too many scientifically or technically trained individuals in policy positions in Government, but "overemphasis" can only follow "emphasis."

As a test on this particular point, one might make a list of the top 100 policy-determining people in the three branches of Government—that in itself might be an interesting research project—and see if the proportion with scientific and technical training fits the general importance of science and technology today.

I recently read in public print the charge that it is the mistakes made by scientists and engineers in Government which have created many of our present national problems. I would not like to leave the impression that scientists and engineers never make mistakes or always decide important questions correctly. I believe they make many mistakes, probably in just about the same proportion as doctors, lawyers, businessmen, bankers, and so forth. But it would be a serious mistake to deprive the decisionmaking machinery of scientific and technological inputs.

Senator JACKSON. You have left out politicians.

Dr. METTLER. Before leaving the role of scientists and engineers in Government decisionmaking, I would like to comment on one element of personal self-confidence at the moment of decision: namely, the troublesome problem of assessing the true technical development status of a major program once it is underway.

The basic problem of determining status is, of course, not unique to the technical field. No chairman of a corporation and no policy executive in Government would dream of proceeding month after month without auditing the financial status of his operations.

It is customary for both corporations and departments of government to regularly conduct internal financial audits. Individuals especially qualified in the practice and the technical intricacies of accounting are employed specifically for this purpose. I suggest the concept of the "technical audit," to be conducted by individuals specifically employed because of their unusual qualifications in the practice and technical intricacies of component and system development and testing.

It is now possible to audit performance parameters such as accuracy, reliability, and range, in system development by means of recently developed techniques, to provide directly to policy-level executives in government, information to assist in regulating the flow of resources to a particular program.

To accomplish this function without excess administrative burden requires that proper steps be taken at the outset in laying out the development program to make a reliable technical audit possible. "Technical audits" have been employed in recent years in several major system programs with outstandingly beneficial results. Wider application of the specialized techniques involved could increase the personal confidence of policy-level Government executives in the correctness of decisions, and would in itself, I believe, speed up the decisionmaking process, both in starting and in stopping.

COMPRESSING THE DEVELOPMENT CYCLE

The importance of compressing the development-production-operational deployment cycle for these large and technologically complex systems upon which we depend for our principal military strength has frequently been stated during recent years. The problems involved in achieving compression of this cycle have also received much attention.

I suggest only that we should consciously identify, study, and learn from those large programs in recent years which the record now shows succeeded in dramatically cutting the development to operational cycle, even in the face of unprecedented requirements for technical innovation and scientific uncertainty.

We should also, however, be willing to identify and learn from those large programs which the record now shows have required excessively long development to operational cycles. I believe a careful, detailed study of the record and experience in the 10 or 15 principal large system programs during the past decade could contribute much to improving our rate of performance, and hence our national security, during the next critical decade. Such a study could examine both the preconditions in starting the program, the correctness of the initial technical and management concepts, and the program implementation itself.

There is considerable evidence to suggest that such a study might also show that the faster programs expend less total money than the slower ones when integrated over the total timespan. Examples of programs made large too soon would probably be found, along with some pushed with priority too late, and perhaps some that were just right.

Fortunately, the recent years provide for study an excellent example of dramatic achievement in compression of the development-production-operation-deployment cycle, in peacetime and fully within the checks and balances of our democratic system of government.

About 6 years ago, it became clear that the Soviet Union was carrying out a large and intensive development effort in intercontinental ballistic missiles. This country had no comparable program. A highly compressed program was rapidly established by the United States to develop, put into production, and operationally deploy intermediate and intercontinental range ballistic missiles.

As predicted by the late Dr. von Neumann, the ICBM program became the largest integrated technical development effort ever undertaken by this Nation. Unusually bold and courageous decisions were made at all levels. The results, fortunately, were spectacular. The Thor intermediate range ballistic missile was developed to the point where it was successfully launched from a military base by a military crew in training approximately 3 years from the date of the decision to initiate the program. Less than a year later—that is, less than 4 years from the start decision—Thor was fully operational in quantity overseas in England, manned by trained British crews.

An operational intercontinental ballistic missile capability was brought into existence in approximately 5 years, along with major Government and industrial and operational facilities, and a solid tech-

nological foundation was laid for later military systems and for the exploration of space.

Technical performance exceeded initial specifications in all major areas. This, in spite of the need for higher thrusts, larger and lighter missile structures, higher speeds and altitudes, higher component accuracies, control of higher temperature, smaller nuclear warheads, and more sophisticated guidance and control systems. The Atlas, Titan, Minuteman, Jupiter and Polaris programs are also examples of development on compressed time schedules.

I do not suggest that all military or space programs should be large and/or highly compressed. All systems are not equally ready for major development and all are not equally important; and of course uniform application of priority defeats its own purpose.

But I do believe we can take heart and learn from the national ballistic missile experience; namely, that with clear decisions and strong leadership, within the checks and balances of our system of Government, our private free enterprise system can do very well indeed. We need not take a back seat behind any nation.

DIRECT COMMENTS ON GOVERNMENT ORGANIZATION AND PROCEDURES

In closing, I would like to offer a series of specific comments on Government organization and procedures, with particular reference to the general topics discussed earlier, and science and technology generally. These are not necessarily in order of importance:

1. In my opinion, much progress has been made during the past 5 years in clarifying and focusing responsibility for strictly technical decision at policy level and for bringing technology more firmly into the national policymaking process. I refer to the appointment of policymaking executives for research and development matters in the three military services; the establishment of a Director of Defense Research and Engineering in the Department of Defense, the appointment of a scientific adviser to the President for science and technology, and the clarification of the responsibilities and authority of the Administrator of the National Aeronautics and Space Administration as contained in the currently proposed amendments to the National Aeronautics and Space Act of 1958. Fortunately the three military services themselves have long included men experienced in technology among their senior officers.

2. I believe it is extremely important to continue the progress made in recent years in unfettering and restoring the authority and operating freedom of the individual senior Government executive at the policy level.

This point is, of course, related to the need for achieving a proper mix of talents in the very top levels of Government. It is also related to the need for a better general public understanding of the complexity and difficulty of major Government decisions.

3. In general, I believe too much Government energy is devoted to building administrative mechanisms to root out duplication. It is clarity in defining fundamental purposes and objectives and the establishment of clear-cut authority to meet these objectives, on the one hand, rather than detailed administrative mechanisms, on the other hand, that will be really fundamental in achieving only the proper amount of duplication.

Significant duplication is actually relatively easy to find and to fix. It is finding and fixing important errors of omission which is hard.

4. I suggest further intensive development of the techniques of reliable and accurate technical auditing by properly qualied people, and a conscious wider application of these techniques.

5. I suggest that we give more emphasis to stating objectives in functional terms in our top-level policy planning and program formulation.

6. Although I have been primarily concerned in this statement with large system programs and primarily with the applications of technology, I would like to state one opinion of the relationship between science and Government. Really good scientific research is a delicate flower and should be nurtured wherever it takes root.

I make a distinction here between "science," on the one hand and advanced technology on the other. Although agencies such as the National Science Foundation and the National Academy of Sciences do not, and I believe should not, play a direct role in the national policymaking process, they can and should help create the proper intellectual climate in our Nation.

They must help build the nutrient which permits technology to grow. In a long-term and fundamental sense, sputnik does not teach us that we necessarily need an enormous space program; sputnik teaches that we need to increase our alertness to and our appreciation of the possibilities of science and technology inchieving our national objectives.

In closing, I am compelled to take issue with the widespread belief that a totalitarian system of government has strong advantages in the development and production of weapon systems because it can create a single monolithic organization, without the supposed handicap of maintaining personal freedoms, to push ruthlessly to meet its military and technological goals.

Obviously, we must recognize that totalitarian systems have many management strengths and are formidable and extremely dangerous. But I am convinced that our system of government has at least one clear management advantage: our bigness is partial, not absolute; democratic, not totalitarian. We have the advantage of widespread diffusion of centers having decisionmaking power.

Our bigness consists of innumerable self-determining, autonomous units: For example, over 100,000 different units of government, municipal, State, Federal; about 4.5 million units of business enterprise; hundreds of thousands of independent financial, industrial, commercial, professional, labor, agricultural, educational, and other associations.

Our society and our system of government are characterized by the interplay among all of these self-generating units, and do not depend for progress upon detailed directives from an impossible superintelligence at the top.

From this characteristic we derive strength which, on balance, outweights certain apparent short-term strengths of a monolithic structure. With proper organization, with wise and bold leadership, our private free enterprise system, teamed with our free government, can provide for our own national security and can serve as an inspiration to peoples everywhere.

Senator JACKSON. Dr. Mettler, I want to commend you for a very helpful statement. I think you have helped to identify the broad areas where we can improve the present programs. I think, too, that you have helped to emphasize our strength as well as the areas that need attention in order to capitalize on that strength.

If I may turn to the last paragraph of your remarks, you have vividly described the interplay among all these free entities in our society. I think you have pointed out the strength of that kind of system.

Would you not say that the problem of maximizing the effectiveness of this freedom, this nonconformity, this nonmonolithic society, calls to our attention the need for proper national goals and national objectives?

Dr. METTLER. Yes, Senator Jackson; I certainly think it does. I believe it also underscores the very problem that this committee is examining; namely, the need for the proper kind of organization to tap the full strength of this marvelous system which we do have.

Senator JACKSON. And if we are going to make the best possible use of this free system of ours, we need to identify the critical areas within a given project, like space, and concentrate on those critical areas, without trying to cover the wide gamut of everything.

I gather that is a part of your recommendation in that area, as an example; is it not?

Dr. METTLER. Yes; it is.

Senator JACKSON. I wanted to talk in general terms about organization. How do you feel with reference to the delegation of responsibility for a given critical project with highly competent and, therefore, of course, well selected people to do the job, as opposed to complex organizations that are set up from time to time, causing people who are supposedly in charge to report to one group after another before a final decision can be reached?

Dr. METTLER. Senator, I feel strongly that to carry out a complex program with heavy scientific and technological components, it is essential that there be a clear delegation of authority and responsibility to a single operating level of management.

In this regard I feel unusually fortunate in that I have participated in a program where this particular thing was accomplished.

Senator JACKSON. That is what I was leading up to, Dr. Mettler. I was interested in the missile program back in 1953–54. In 1954 it really started to get underway. As I recall, one of the big problems that Air Force had in the initial stages of the effort was the fact that in order to get a decision, they had to go through so many committees and so many assistant secretaries that decisions were delayed. Gradually these obstructions were removed.

I take it that, therefore, you feel that the important thing is first to get competent people in charge; I mean delegate responsibility to highly competent, capable people——

Dr. METTLER. Yes; I do.

Senator JACKSON. Place responsibility on their shoulders, make them deliver the goods, and then, assuming that the project is in keeping with our national objectives, try to provide a minimum amount of interference in carrying out their assigned mission.

Dr. METTLER. I would certainly subscribe to the process you have just described.

Senator JACKSON. The reason I asked this question is that I followed with interest, starting in 1949, the work of Admiral Rickover, then Captain Rickover. I remember that he was sort of a one-man organization. Directives and all sorts of bureaucratic, entangling barbed wire did not, somehow entangle him.

The result was that this country was first in nuclear propulsion. I think he is an outstanding example of what I am trying to get at in the way of the importance of people.

So I take is that you feel that in considering this organizational problem that a primary consideration—I do not say it is necessarily the most important—is the selection of competent people who can stay with a given project. Would you say that?

Dr. METTLER. Yes; I would certainly say that having selected clearly the objective in functional terms, so that it is clearly understood what the desired end point is, the next most important step in the implementation process is to assign that objective clearly and with the proper authority to an appropriate organization.

Senator JACKSON. While we are in this military area, do you feel that as long as military officers are involved in science and technology, there should be some departure from the customary military practice of moving people around constantly?

Dr. METTLER. I certainly do. In my view, the problem of managing and generally carrying out the responsibilities of the Government in a large program are such as to be almost incompatible with the standard rotation and shifting of individuals, which sometimes occurs.

Senator JACKSON. General Schriever is certainly an example of the wisdom of providing for continuity of assigned service in connection with the ballistic missile program; would you not say?

Dr. METTLER. Yes; I certainly would agree with that.

Senator JACKSON. I know that the services are making some changes in that regard, but I personally feel that not all of them are fully cognizant of the change that has occurred in modern warfare as a result of science and technology. I am happy to hear you say that the practice of assigning and reasigning officers who are engaged in these technical programs at least should be minimized, where critical projects are involved.

How do you feel about international cooperation in the satellite program? Some of us last year recommended at NATO satellite project as one example of international cooperation.

Dr. METTLER. I believe you have struck a resonant chord there. I feel that there is a tendency to become so enmeshed in our projects in the space field, in our individual projects, as to somewhat underestimate the enormous impact which a space experiment has. When a satellite gets far enough away, like 5 million or 6 million miles, it tends to make this little globe on which we live look pretty small.

I believe there are enormous possibilities for accomplishing serious scientific obectives while simultaneously encouraging the kind of international cooperation with such experiments and programs that might lead to international cooperation on a broader scale.

Senator JACKSON. Is it not a fact that even some of the smaller countries in our European, Western community can make some rather substantial contributions in the construction and development of

vehicle systems—I am thinking of electronics, miniaturization, and so on—even though they do not have the resources to develop their own systems of thrust?

Dr. METTLER. I certainly believe they can contribute. Judging from our own mail in the days following the recent space shots, there is a clear, worldwide interest in the centers of culture and at universities generally throughout the world, most of whom could, I believe, support, with a little help, the development of small components and pieces, even though they might not have and may never have a large thrust rocket.

Senator JACKSON. At the NATO Parliamentarians meeting in 1958, where I served as chairman of the Science Committee, Dr. Theodore von Karman felt very strongly about the importance of working with our allies in this type of scientific undertaking, because they could make a realistic scientific contribution in an area of great interest to them.

He referred, to be specific, to the area of meteorology. I think we have some very competent weather people in some of the smaller European countries, as well as in the larger ones. He cited that as an example of where they could aid in a meteorological satellite and the followup in the evaluation of findings from such a satellite system.

Would that be an example?

Dr. METTLER. Yes; I agree generally with the point, and I agree specifically that meteorology is an area in which one might arrange a tighter coupling between the effort in this country and efforts in the free world generally.

Senator JACKSON. Dr. Mettler, I liked your remarks where you pointed out the value of the functional approach to the space problem.

It seems to me that by following this route, the Nation could save a lot of dollars and also a lot of its important scientific resources by properly defining its national objectives, without going helter-skelter in all directions.

I take it you feel that the importance of the space program, for example, to our international prestige, is clearly a proper national objective.

Dr. METTLER. I believe it is. I think, having thought about this question a good deal, that there are really four reasons for engaging in space projects. One is certainly a contribution to the national security; one is certainly scientific research; I believe one is specifically to add to our international prestige; and finally, it is not inconceivable that space programs can actually contribute to economic development.

If I might use an example, worldwide color television to help dissolve the Iron Curtain is certainly technically possible. If this is a proper national objective, it certainly can be done technologically.

Senator JACKSON. Dr. von Neumann, I believe, back in about 1954, in an article in Fortune, spoke glowingly one day of scientists controlling weather. I am using it in a very broad sense, of course. Certainly he mentioned that a better knowledge about weather and the prediction of weather would first of all be of great economic benefit to mankind.

Dr. METTLER. I believe so. I think starting with weather observation, the means of predicting the trend, would certainly be a typical and, I believe, potentially very useful application.

Senator JACKSON. Knowing how hurricanes are formed, and the ability to learn more of just how weather itself is formed, by observation from great distances from the earth.

Dr. METTLER. Absolutely.

Senator JACKSON. So one could also say, in connection with prestige, I take it, that there might be such things as political satellites in the support of international political objectives.

Dr. METTLER. I think there might.

Senator JACKSON. I am not trying to confuse this with Iron Curtain satellites.

Dr. METTLER. I do not think it is desirable or necessary to conduct space experiments which are stunts. However, I also say I do not think they need be stunts. In fact, they can best serve their purpose in a long-term sense of contributing to our international prestige if they are legitimate, serious undertakings.

Senator JACKSON. In other words, good scientific satellites have good political implications for the furtherance of our own national objectives.

Dr. METTLER. I believe so. I do not really feel I am as competent to judge as perhaps other people what is good or bad politics. But I do believe that one should forthrightly accept and use the possibilities of space vehicles and space exploration generally to enhance our prestige throughout the world. I do not see any point, any reason, anything to be gained by being shy on this point. I just think we should do it.

Senator JACKSON. I think it is clear that whether we like it or not, this country has always been known for its scientific and technical competence. We have not necessarily stood at the top of the list when it comes to culture, but we have been identified before the world as the country that can always get things done in these areas. Therefore, we can ill afford to bypass certain great exploratory areas that will be explored whether we like it or not.

Dr. METTLER. Yes; I believe that is right. And I would add that I think a critical point is to insure that those nations that are observing our progress and our activities clearly see that we can, that this culture and this system of government can conduct even very large, even global undertakings within the checks and balances of its system.

I think it would be a very devastating thing if the uncommitted nations of the world felt that one needed a monolithic, totalitarian system in order to carry out the kind of large, technological programs which are obviously here and increasingly likely to be carried out in the future.

Senator JACKSON. Good organization at this point becomes of critical importance, does it not, in the identification of the right projects, so that one does not get involved in too many different directions that are not in keeping with one's national objectives?

Dr. METTLER. Yes; I am convinced it does. One might say that we need wisdom along with imagination. I think it is easier to imagine a long list of programs than to pick out the ones that should really be accomplished.

Senator JACKSON. Now, if I may turn to that point in your statement where you use a private corporate analogy of a technical audit, I wonder if you could enlarge on that?

At one point you say:

"Technical audits" have been employed in recent years in several major system programs with outstandingly beneficial results.

Could you just elaborate a little on that?

Dr. METTLER. Yes; I could. I will try to do it without getting into the special language that people use when they talk about these things.

Senator JACKSON. If you wish to refer to your own organization, do not hesitate. I think your organization has had an outstanding record. Do not be shy about it.

Dr. METTLER. Thank you. I will try not to make it sound like a commercial.

I think one might develop the point as follows:

The general techniques employed in putting together larger and larger aggregations of equipment to what is called the "system" are relatively new. It is not so long ago that one spoke of the "ignition system" of an automobile. So the word "system" occurs over and over again these days, when considering something like a ballistic missile or space system, by any previous definition, it should be called a supersystem.

Recognizing this complexity, and hence its probable bearing on decisionmaking, a system of this kind is sufficiently complex that it is very difficult to know at any given point of time where all the parts and pieces really stand. There is the haunting doubt that the watchspring will not get there in time to put all the other 10,000 pieces together.

In the past 10 years or so, and increasingly in the last 4 or 5, by a straightforward attempt to isolate those elements of performance which can create visibility for the management of the program, it has been possible to track rather well the performance of individual parts of a complete system and to interrelate their potential effect on the total program in such a fashion that it is possible for the management generally—and I believe this includes Government executives in even larger enterprises—to have that kind of information concerning whether or not the reliability, for example, objectives of a weapon system are being met which will permit one, by examination of data available today, to predict and understand what the performance is likely to be several years from now.

Senator JACKSON. So it is not only a current auditing system in which you are advised of what the situation is, but it is also a qualitative procedure?

Dr. METTLER. What one starts with is a realistic audit of what the current status is. In employing such information in decisionmaking, one must then translate the audit of current status into its possible effect on the future status of the program.

If one properly isolates the correct items and selects the right things to look at one can, with a relatively small amount of effort compared to the total program—characteristic of what one thinks of by the word "audit"—literally audit the current technical status.

I hope I have not confused you.

Senator JACKSON. No. Let me see if I can put this a different way. Then I can perhaps translate this.

What you have related is the techniques that you use where you are developing an important and vital system for the Government, we

will say. This is the internal mechanism that you are talking about within your own organization.

Dr. METTLER. Yes.

Senator JACKSON. This makes it possible for you to report just where you stand from day to day.

Are you suggesting that maybe some of these techniques might be used, for example, within the Department of Defense, in keeping tab on not just one, but several systems that are being developed?

Dr. METTLER. Yes; that is specifically what I am suggesting.

Senator JACKSON. Has there been any effort, as far as you know, for the Government to take advantage of this experience that has been apparently quite effective in the development of these complex systems?

Dr. METTLER. Yes; there has been some effort. I think it is a new and unfolding process. I personally have had conversations, for example, with Dr. York and his immediate associates on this particular point.

My reason for bringing it up and putting it into the statement is that I believe that it is a part of the general evolution of the techniques for developing and building large, complex devices.

Senator JACKSON. Computers have helped a lot in this field, have they not?

Dr. METTLER. They have helped, but the sort of thing I am really referring to here depends more on qualifications of the individuals and their charter to perform this operation than it does on a mechanistic use of the computer.

Seantor JACKON. I really meant computers that are fed by competent people cranking in the right data, of course.

Dr. METTLER. Yes.

Senator JACKSON. Because it has to start from a premise of some validity. I am thinking, therefore, of a computer as a tool in the hands of competent people.

Dr. METTLER. I believe there is much opportunity for the application of such techniques.

Senator JACKSON. While we are pursuing this point, Dr. Mettler, I wonder if you feel that there is room for improvement in getting better people at the critical levels of government that must make decisions that are based on recommendations that come in from private corporations, nonprofit corporations, by people of great competence because they have been selected without regard to salary limitations and that sort of thing.

As you know, our next set of hearings, as I indicated earlier, will deal with the role of people. That is week after next.

Dr. METTLER. Yes.

Senator JACKSON. I have had the feeling that we have done quite well in using the contractual device, first used on a big scale in the Manhattan Project, then in the Atomic Energy Commission, in getting the best possible talent to bear from private enterprise.

I think we have accomplished some miracles in other fields by utilizing, as I say, the great and rich experience of private corporations, universities, nonprofit corporations.

What does disturb me is this: In those areas where we have contracted these things out, the contractors have done an excellent job;

but I wonder if you could say that we have done equally as good a job at the governmental level, in trying to make available people who can act, act with some decisiveness, and act competently, with imagination, with respect to the work done by the private contractors.

Dr. METTLER. I would certainly be happy to comment on that. I believe that it certainly has been possible to bring good people, trained in science and technology—and I will limit my comments to this field, because I am most familiar with it—into government. Names like Kistiakowsky, York, and Glennan are certainly an illustration of this.

Senator JACKSON. I want to say I concur with you. I was not speaking in a derogatory sense of anyone. I am just speaking of a broad need.

Dr. METTLER. I understand that.

I do believe that there is a critical need, and it is clearly, without question, one of the most critical problems, to bring more such people into government.

I have not personally experienced the problem of attempting to attract people into the Government and seeing why they refused or why they left. But I would suggest, if it has not already been done, that it would be reasonable to examine in detail the reasons why the last 100 people, for example, that have been asked into important positions in the Department of Defense or State or the Government generally, have turned the job down, or why they have left when they were already in the Government.

One would have to do such a thing carefully and anonymously but I think the statistics might be of benefit. I might say that I do believe that the conflict-of-interest interpretation has been extreme, that there needs to be a modernization, if I may use that word, of the principle, which, of course, is clear and understood.

Senator JACKSON. I am glad to hear you say that, because those laws were passed a long, long time ago, and a House committee is undertaking some hearings on that. We will get into that the week after next.

I feel that in addition to taking action in that area, which is negative, that is, the removal of barriers that were based on conditions that no longer exist, some arrangement must be worked out whereby the Government can contract with universities, nonprofit corporations, and private corporations for use of top personnel for given periods of time in which the interests of both parties, the Government and individual entities, can be protected.

I do not see how, Dr. Mettler, we—and by "we" I mean the Federal Government—can do this job that has apparently been cut out for us, which may take 10, 25, or 50 years, and do it with just Government personnel in the general definition of that term.

It seems to me that with the complex requirements that the Federal Government must meet in areas that were undreamed of just a few years ago, it is inconceivable to me that we can do it with the regular, shall we say, career-type of Government personnel alone.

Is that an unreasonable view?

Dr. METTLER. I think I would agree with that. There are, of course, as I think everyone is familiar with, a series of different problems. I would suggest that a portion of the problem that deserves special

attention is the length of time that the critical policy executives spend in the Government.

Senator JACKSON. I wanted to ask you if you had any comments that you might make in a constructive way, as you have been here today, regarding any organizational problems that you have been up against in your experience, where you feel some improvement has been made and can still be made.

You have certainly undertaken some very vital tasks and, I think, achieved some effective results, indeed, in the management of important systems. Could you just start out by indicating what your problems were at the outset, in general terms, and then what improvements have occurred and what you still hope for in the way of improvement?

Dr. METTLER. Yes; I can comment on that.

As I indicated, I believe myself fortunate in having been a part of and having participated in a program, the ballistic missile program, which I believe is unusual in that it has been exceptionally well handled in this respect.

In general, as a matter of fact, the problems that we have encountered have been recognized and hopefully, in most cases, overcome in a fairly straightforward fashion.

I think I would comment on the difference between this country today and, generally, those situations where a large program is set up for what one might call a pure objective; that is, if it is a pure military mission or a pure scientific mission, then generally one has available machinery to work with and to work on.

One of the most troublesome problems, and one of the most difficult, really, is the carrying out of those programs where it takes the summation of contribution to a number of different objectives to create the full justification for a complete program.

Senator JACKSON. And this takes time.

Dr. METTLER. This takes time. It is very difficult. My personal experience has been one that has been clear and straight.

Senator JACKSON. It has taken time, but you would hope there would be some means by which that time factor could be compressed.

Dr. METTLER. Yes. As we all get smarter about these things, I think it should be possible to do some compressing.

Senator JACKSON. Senator Gore, did you want to ask a question now?

Senator GORE. I believe not. I have enjoyed the testimony of the distinguished witness, but having arrived in the midst of his testimony, I believe I will desist.

Senator JACKSON. If you want to ask questions later, fine.

Mr. Pendleton?

Mr. PENDLETON. I must say, Dr. Mettler, that the prepared statement you have made here was one of the finest statements of a belief in our country and in the features of its government that I have heard. I almost felt like clapping when it was over. It was very good, and we appreciate that kind of breadth being brought in here.

In view of what we saw in the press the other day, however, I should not have been surprised to learn of your ability in this field. I saw that one of your people had repaired a satellite 5½ million miles away.

Would you mind, in very simple, two-syllable words, telling us how you do that?

Dr. METTLER. You are talking to the relative of a baby in a baby contest, at this point. I saw that article, too, and was interested in the construction put on it.

What happened was that a particular component in Pioneer V, which is about 5 million miles away, failed. One of the things one does in designing that kind of a system is attempt to insert redundancy, so that if a single component fails, the whole system does not fail.

By examining the messages coming back, it was possible to determine what particular tiny component from among many thousands had, in fact, failed, and it was then possible to essentially change the code, translate it into a different "language," and continue to determine what the actual data was.

It is an interesting bit of experience, in that it was possible to continue to receive useful messages from this particular space probe, even though one of a number of thousands of components failed.

Mr. PENDLETON. Do you think the Russian satellites are good enough to be repaired 5 million miles away?

Dr. METTLER. I really do not know. I would rather not say. We do not know what is up there.

Mr. PENDLETON. Thank you, Mr. Chairman. That is all.

Senator JACKSON. Senator Gore?

Senator GORE. How big a payload can we hoist a million miles?

Dr. METTLER. How large a payload can we hoist a million miles?

Senator GORE. Yes.

Dr. METTLER. I am not sure I can pull the answer to that out of my head at the moment. I suspect that at this point it is in the vicinity of 1,500 pounds.

Senator GORE. Sufficient for a nuclear warhead?

Dr. METTLER. Oh, yes; certainly.

Senator GORE. Sufficient for a nuclear weapon and a stage which could be separated for telemetering?

Dr. METTLER. Yes.

Senator GORE. Then it would follow, would it not, that the United States now has the capacity in nuclear tests of detonating a nuclear weapon 1 million miles from the earth and telemetering the results back?

Dr. METTLER. It does follow, and it is possible; yes.

Senator GORE. In what order of magnitude—well, I might get into classified information here. I will rephrase my question. Would it be possible to thrust a nuclear weapon of megaton capacity to this distance, or would it be confined to kiloton capacity?

Dr. METTLER. I am quite certain it would be a weapon of megaton capacity.

Senator GORE. Doctor, if the United States now has the capacity to do this on the megaton basis, what would be your view of the Soviet capacity in this particular regard?

Dr. METTLER. I am almost certain, judging from what we know of their Lunik, for example, that they have the thrust and vehicle capability to do the same thing.

Senator GORE. They have greater capability of thrust than we have yet developed, have they not?

Dr. METTLER. Yes.

Senator GORE. Doctor, what would be the comparative cost of thrusting a thousand pounds 1 million miles into space with a telemetering stage and the digging of an underground cavity sufficient to conduct a megaton test with instrumentation? Would you be able to give us an estimate on that?

Dr. METTLER. I certainly would not. I cannot answer it. I can comment that I am sure it is possible to get a rational, detailed answer; but I cannot answer it out of hand.

Senator GORE. Although such opinions have been expressed to me privately, insofar as I know, this is the first time a competent scientist has made a public statement that we now have the capacity of conducting a megaton nuclear test 1 million miles from the earth and telemetering information back. It seems to me that this is information to which the people of the United States are entitled.

I know that when this particular probability was suggested as within the capacity of the Soviet Union a few months ago by the junior Senator from Tennessee, being a nonscientist, he was the butt of a good deal of ridicule. I am glad to hear that we now have such a capacity.

Would you be able to express an opinion on our capability of detecting such an explosion at this distance, or several more million miles into space, on the party of some other country?

Dr. METTLER. I could not express that opinion, because I just have not personally worked on that problem. I am, of course, aware that studies of this problem have been made.

Senator GORE. Thank you, Mr. Chairman.

Senator JACKSON. Thank you, Senator Gore. I think your questions have been most helpful, and I think it brings to bear the problem of detection of tests in outer space. We had some discussion this morning about the problems of underground detection, of underground shots, and I know that Dr. Teller and others have expressed their concern about the problem of detecting underground shots of certain yields and the detection of shots, nuclear and thermonuclear, far out into space.

Senator GORE. Would you yield just a moment, Senator Jackson?

Doctor, once the payload is thrust 1 million miles, once it escapes the gravitational pull of the earth, additional distances are fairly economical; are they not?

Dr. METTLER. Yes; and also unavoidable.

Senator GORE. Excuse me. I will go now. Thank you.

Senator JACKSON. Dr. Mettler, needless to say, we are indebted to you for your contribution today, and we hope that we will be able to call on you later when we get into some more specific recommendations. Your statement and your answers in response to questions have been very helpful indeed.

Dr. METTLER. Thank you very much.

Senator JACKSON. The Chair would like to announce that, as he indicated earlier today, the first witness tomorrow will be Dr. Eugene Wigner, to be followed by Dr. Edward M. Purcell, and the last witness, who will probably be in the afternoon, will be Dr. Herbert F. York.

The subcommittee will stand adjourned until tomorrow at 10 o'clock.

(Whereupon, at 3:30 p.m., the subcommittee recessed, to reconvene at 10 a.m. Wednesday, April 27, 1960.)

SCIENCE, TECHNOLOGY, AND THE POLICY PROCESS

WEDNESDAY, APRIL 27, 1960

U.S. SENATE,
SUBCOMMITTEE ON NATIONAL POLICY MACHINERY,
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10 a.m. in room 3302, New Senate Office Building, Senator Henry M. Jackson (chairman of the subcommittee) presiding.

Present: Senators Jackson and Muskie.

Also present: Senators Bush and Stennis.

Staff members present: J. K. Mansfield, staff director; Dorothy Fosdick, Grenville Garside, and Howard E. Haugerud, staff members, and Edmund E. Pendleton, minority counsel.

Senator JACKSON. The committee will come to order.

This is the third and final day of our second set of hearings on science, technology, and the policy process. The question now before our subcommittee is this: What is the right way to organize our Government to get the right scientific and technological programs at the right time?

The subcommittee's search for answers to this question represents one part of a broader task. That broader task is to determine whether our Government is now properly organized to meet successfully the challenge of the cold war.

Yesterday we heard from Dr. James Fisk, the head of Bell Laboratories, Dr. William Pickering, head of the jet propulsion laboratory, and Dr. Ruben Metler, the executive vice president of Space Terminology Laboratories.

Our first witness this morning is one of the most distinguished physicists of our time, and of the world. He is Dr. Eugene Wigner, professor of mathematical physics, Princeton University. Dr. Wigner is also the recipient of the U.S. Medal for Merit, the Enrico Fermi prize, and he is designated to receive the Eisenhower Atoms for Peace Award this year, I believe, in a month or so.

I might also call to the committee's attention the fact that I believe on the opening day of the session I mentioned the five famous scientists from Budapest, Hungary. We have one of the five here this morning, Dr. Wigner. The other four distinguished scientists include the late Dr. John von Neumann, the world's greatest mathematician; Dr. Theodore Von Karmen, world famous aeronautical engineer, if not the greatest living aeronautical engineer today; Dr. Leo Szilard, who unfortunately is in New York in critical condition with cancer; and the last is Dr. Edward Teller, better known as the father of the hydrogen bomb.

There are many things I could say about our distinguished witness this morning, but as I mentioned the other morning when Dr. Perkins made the point that mathematics is a detection device for picking out good scientists for the future, the five famous and distinguished scientists from Budapest had all won prizes in mathematics in high school that started them at least in a substantial way on their distinguished scientific careers. I believe they all grew up—of course they are different ages—but not too far apart in this town of Budapest. We are all grateful for one thing, and that is they went west and not east.

Dr. Wigner, it is a real honor for us to have you with us this morning and I believe you have a prepared statement. You may proceed in your own way.

STATEMENT OF DR. EUGENE P. WIGNER, PROFESSOR OF MATHEMATICAL PHYSICS, PRINCETON UNIVERSITY

Dr. WIGNER. I deeply appreciate the opportunity to speak here today. Little did I dream of such an opportunity when I landed, some 30 years ago, on a gloomy February 8, on these shores.

The two questions which were asked me concern the progress of U.S. science and technology, particularly its relation to Russian progress, and the effectiveness of the administration of our scientific and technological programs. Before I go further, let me say that any competence which I may have for answering these questions is largely confined to the area of physics. My knowledge of the situation in other fields is derived principally from conversations with others.

Perhaps I might summarize at this point the main conclusions which will follow:

1. In pure science, we are strong at present and, as of now, our leadership has not been effectively challenged.

2. The situation is less favorable in applied or "mission oriented" science, especially in military applications. In particular, the U.S.S.R. does not seem to be lagging much behind us and it is ahead of us in many regards.

3. We must do our best if we wish to prevent the Russians from surpassing us in applied science and technology. Unless we can more nearly parallel their purposefulness, they will prevail.

This applies not only to science but also to our human approach to other people.

4. In order to take full advantage of the strengths inherent in our system to promote mission oriented projects, the following measures are recommended:

(*a*) We should make every effort to find strong and competent leaders for our crucial projects. Once such a leader is appointed, he should be given adequate time, money, and authority to make substantial progress.

(*b*) We should suppress programs without hesitation if they either do not show adequate progress during the time specified, or if changing circumstances render the objectives of the program unnecessary.

(*c*) Committees should be used to initiate projects, to select leaders for them and to review their progress after the period specified. They should not interfere with the project during the time for which it was set up.

(*d*) Both in pure and in applied science, we should strengthen collaboration with scientists of other nations, not only by maintaining laboratories abroad, but also by offering at least temporary but preferably permanent employment on a larger scale.

(*e*) We should try to make the exchange of information on applied science more nearly a reciprocal affair.

These are the five recommendations I would like to make. I know how easy it is to make recommendations but I realize how difficult it is to carry them out.

Let me make, next, a few remarks about the difference between pure science, about which I am not particularly concerned now, and technology and mission oriented science, in which we are not out in front.

I mean by pure science the effort to become acquainted with the laws of nature. Mission oriented science and technology are efforts to increase our power and ability to do something. The difference between the two is, therefore, principally in the objective of the effort, but this is not all. The whole spirit of the endeavor is different, depending on whether one wants to know, for instance, the laws of gravitation or wants to construct a machine which abolishes gravitation in a certain area. Nevertheless, as this example shows, the two endeavors cannot be sharply separated.

PRESENT SITUATION

As to our strength in pure physics, I have made a list of the most important experimental and theoretical discoveries which have been made since the war. The list is reproduced as an appendix. (See p. 384.)

Senator JACKSON. The lists will be included in the record at the conclusion of your remarks.

Dr. WIGNER. Even allowing for a certain bias on my part—which I have tried to compensate for but perhaps not adequately—it is evident that our position is very strong. If I look at the table it shows nine theoretical and nine experimental discoveries made in the United States and three of each in the U.S.S.R. and about the same number made in the rest of Europe. It is important to realize that the past is never a measure of the future and *the situation may change any day.* It is also important to realize that the list refers only to physics—even in mathematics, the list of most important discoveries would not be weighted so heavily in our favor. However, in pure physics and at the present time, there is not much cause for alarm. Our science is vigorous and we are, on the whole, successful.

The situation is much less favorable in technology and in applied physics, in particular in military applications. It does not seem that the U.S.S.R. is lagging behind us very much in these fields and it is ahead of us in many regards. The first sputnik is still vividly in our memory and some believe—and some Russians claim—that they were the first to explode a hydrogen bomb.

I would like to make at this point a few remarks, pointing to the dangers of the situation in which we excel in pure science, the Russians in mission oriented or applied science and technology. The military strength depends more on a successful technology than on the ability to discover the laws of nature. Furthermore, and very importantly, our scientific discoveries are freely published and are at

everyone's disposal almost as soon as at ours. This is not true of technological breakthroughs, and the Russians, in particular, are very successful in concealing them. We still do not know very much about the technology of the first sputniks and we may be ignorant even of the scientific results which they furnished. It is hard to believe that the large Russian satellites' scientific exploits were so much more meager than those of our "grapefruits," to use Khrushchev's words. The danger is very great, therefore, the U.S. science works for the whole world, whereas Russian science works for the increase of their might. Dr. Wallace R. Brode made a very similar point in his response to the award of the Priestley Medal. Maybe Mark Twain was not so far wrong when he said that truth is our most valuable possession, we should be economical with it. Perhaps we dispensed it overgenerously. Certainly, the power relations would be different today had we withheld the publication of our results on transistors for a few years.

REASONS FOR THE PRESENT SITUATION

It is natural to ask whether our strength in fundamental science, and the Russian strength in applied science, are somehow results of our social systems. It is surely impossible to answer this question categorically. Nevertheless, there are elements in our system of government which favor the flowering of pure science, and there are elements in the Communist system which support applied science more strongly.

Let me make first a few remarks on the first point. In his inaugural lecture at Leiden University, Professor Van Vleck has brought out the point that fundamental science flourishes best in an atmosphere of freedom where the flight of imagination is not hampered by the apprehension lest the results may displease the authorities, where one is not used to suppress one's thoughts on any subject for fear that they may run counter to some official doctrine. Particularly since the official doctrines in Russia hardly relate to the physical sciences, Van Vleck's point remains doubtful. We may recall that absolute freedom not only of thought but of publication was widely claimed after the war to be an absolute necessity for successful work in pure *and* in applied science. The Russian success in applied science, achieved in complete secrecy, surely exploded this doctrine. Nevertheless, it is perhaps more than a comforting thought to believe that the sense of freedom, the feeling of liberty, foster the higher flights of the imagination.

Some of the causes of our strength in basic science are perhaps also the sources of our weakness in the applied sciences. Our best people are diverted from the applied field, and it is not easy to find a first-rate scientist working in an applied physics laboratory. The situation is apparently very different in Russia where the scientist cannot choose his own field equally freely, and many of them are diverted into the applied and into the military laboratories.

A friend of mine a short time ago asked a Russian friend of his why the progress of Russian pure science is less vigorous than he would have expected and his Russian friend said, "You know, we were mobilized until recently."

Senator JACKSON. That is a good substitute word for dictatorship.

Dr. WIGNER. In addition, according to the Communist doctrine, the prime, if not only, purpose of science is to find technological applica-

tions and this belief, surely widely held, unquestionably benefits technology in Russia. Also, as mentioned before, the relation between United States and U.S.S.R. technologies is not symmetric; we teach them what we have found out not only in science but also in technology to a far greater extent than we learn from them what they have found out.

Finally, the Russian political system renders it much easier to control and direct the applied and technological work. In particular, it is very difficult for us to discontinue some line of work even if the promise or purpose of it has ceased to exist and even if it was undertaken, to begin with, only as an insurance. Any plan to discontinue a project provokes cries of protest often with only thinly veiled references to the possible harm to the reputation of the contractor and to dislocations in the lives of its employees. These protests often take the form of leaks to the public press in which public indignation is provoked that we permit the Russians to get ahead of us in the field concerned. No need to say, these difficulties do not exist in Russia and if, in the best judgment of those in charge, a project has ceased to be useful, it is discontinued without further ado. I have heard of military installations turning out, for longer or shorter periods, sewing machines. The sewing machines were not particularly good but the conversion of a useless military plant into a sewing machine factory saved the necessity of building a new sewing machine factory. It would be very difficult for us to do something of this sort.

The last point brings up a general observation which might well have been made under the heading of "Present Situation." If one looks at the two countries—at the United States and at the U.S.S.R.—with some detachment, one finds the one happy and comfortable, with most of its desires and ideals close to realization. The other one strains every muscle to get ahead of the former, to increase its might and power. This purpose is in the minds of its leaders whenever they make any decision, whenever they lie down, and when they rise up. Unless we can more nearly parallel their purposefulness, they will prevail.

MEASURES TO IMPROVE THE SITUATION

I now come to the second question on which I was asked to comment: The management of the program. I am afraid the measures I advocate are tiny measures. The principal measures I would like to advocate are in the psychological and emotional field but those are not things which would well fit in with questions which I am competent to answer.

The preceding section enumerated the advantages which a totalitarian regime has in guiding and controlling applied science. We should more fully take advantage of the strengths inherent in our own system. There are several specific measures which I wish to advocate.

If a job has to be done, the desirability and possibility of which has been attested to by the consensus of the military and scientific community, a leader shall be chosen with very great care to guide it. However, once the leader is chosen, he should be given adequate funds and sufficient time to make at least very considerable progress. During this time, and while he stays within his budget, he should be let alone and should not be subject to pressures and inquiries. I am think-

ing of arrangements similar to those made for the Manhattan project during the war, the success of which, according to General Groves' own opinion, would not have been possible if it had been constantly investigated and if it had not had a good deal of independence and freedom to use the judgment of its leaders. At the expiration of the period given to the project, the leaders should be called to strict account and if, either because of the weakness of the enterprise, or because of changed conditions, its continuation is no longer in the interests of the country, it should be discontinued without regard to sensibilities. The procedure outlined differs from the present one by using the individual initiative and interest of the project's scientific talent more fully, by its wholehearted delegation of authority, and by its insistence on responsibility.

The procedure outlined demands great sacrifices from the present authorities and also from Congress. Neither of these likes to abandon its day-to-day influence and both are afraid that the ultimate control may slip away from them. These sacrifices are necessary.

The ruthless suppression of the project at the end of the specified period, either because of lack of adequate progress, or because of changed circumstances, is an integral part of the proposal. In particular, we should not continue a project of marginal value just because of an outcry "the Russians will get ahead of us." It should be understood by all that any well organized country can pass us in any particular field of pure or applied science if it concentrates its effort on it. The sooner we adjust our thinking and statements to this fact of life, the better it will be for us. I would like to quote here a sentence from an article, "A Bitter Pill," in the Physikalische Blatter, which is the West German Physics Today (1958, vol. 1, p. 48):

> It is a source of disappointment that it is attempted (by the U.S. science) to maintain at every price the glory of the one who is superior always and in every regard. We should maintain, rather, a balanced program, as vigorous as we can make it, but based on our own estimate of the national needs and requirements.

Let me make a few remarks, next, about scientific collaboration, particularly with our allies. If we compare the size of the scientific personnel trained in our colleges and institutions with the size of the scientific personnel trained in Russia, it becomes at once evident that we must husband our forces and make the most effective use of the joint scientific personnel of the free world. The resulting scientific collaboration will also strengthen the bonds between the free countries but I am not now concerned with this point. Right now, I wish only to emphasize the necessity of maintaining or achieving a strong position in applied science where we are in danger of being surpassed. This danger is further increased by the fact that we are not able to choose the time and area of the conflict.

There are two ways toward a more effective collaboration which I can see. The first is the elimination of unnecessary duplication of technical work, here and abroad. In many cases, if a line of work abroad appears to be promising, we jump at it even though, as a result of agreements, its accomplishments would be available to us anyway. This is wasteful and the temptation to have a finger or even a fist in every pie should be resisted.

Second, shortages in our technical personnel could be much alleviated by employing more foreign scientists in our country. I am not

thinking of employment for months but of permanent employment. You may know that I myself was "imported" in this way into this country and it has been alleged that this and other similar imports have paid off. A particular way of importing foreign science is the foundation of research laboratories abroad as has been done by several of our leading organizations. This is a good way; bringing the scientists to this country is better.

The last point I wish to make has nothing to do with any particular competence which I may have in physics. It relates, however, to so striking a phenomenon that it would be very difficult for me to let this occasion go by without calling emphatic attention to it. It is that whereas human dignity is infinitely more cherished in our civilization than in that of dictatorships, whereas the recovery of Western Europe, under our economic system, was vastly faster and more complete than that of Eastern Europe and was accomplished, furthermore, at the cost of infinitely less suffering, that whereas in our civilization the power and comfort of the poorest is very much closer to the power and comfort of the richest than in the Communist nations, nevertheless, a large part of the world believes that human dignity is more respected in Russia than in America, that communism is the road to quick economic progress, and that the communistic governments bring equality of power and wealth between rich and poor. These misconceptions are so widespread, so tenaciously held by such multitudes of people that one can only wonder whether we are unable to communicate our ideals and accomplishments or whether perhaps we made it more profitable for people to confess to the falsehoods which I enumerated.

The struggle for men's minds is on and it is quite possible that the conflict between democracy and dictatorships will be won not by the armies, not even by the scientists, but by the philosophers, psychologists, and missionaries who articulate and communicate our ideals.

There is a saying that the First World War was won by the chemists, the Second World War by the physicists, and possibly the third world war will be won by the philosophers.

So far we have been remiss in joining the fight for the minds and loyalty of other people. There are many in our own ranks who are misled, and fewest are misled behind the Iron Curtain. In order to join the fight, we must enlist the active help of the philosophers, psychologists, and all those who are familiar with the working of the human mind and the human emotions and who share our ideals and aspirations. Our efforts so far are pitiful if compared with the accomplishments of those who have guided, or misguided, human emotions in the more or less distant past. We have reluctance, based on our past and traditions, to fight for the loyalty of others, to explain the ideals which are dearest to us. Unless we teach ourselves to overcome this reluctance and make a true and systematic effort in this regard, we shall be taught by the circumstances to do so, and this will be just as unpleasant as it was unpleasant for all nations to be forced to adopt a new weapon by those who used it effectively.

Thank you. This ends my statement.

Senator JACKSON. Thank you, Dr. Wigner, for a very thoughtful and a most provocative statement indeed on this important subject. I will ask a couple of questions and then turn the questions over to my colleagues.

I take it that your position in general is that in pure science we have a clear lead but in applied science and technology they have a lead. What it boils down to is that we have in fact the human talent, the resources to utilize but we are not directing them properly on key and vital projects.

Dr. WIGNER. This is what I tried to say.

Senator JACKSON. I think you have brought this out very clearly. From time to time there has been much confusion about our scientific capability. I for one have always felt that we have the scientific resources. It is a question of our purposefulness. It is a question of whether we are going to have some direction in our society in those areas which affect our survival. The Russians have been able to take a situation wherein they have only had about 40 years to do this enormous job but with limited resources they have channeled and marshalled them in the right direction, which has added enormously to their power.

Dr. WIGNER. Perhaps I should say the Russians were excellent in pure science much before the Communists came to power.

Senator JACKSON. I meant in quantity. They had great and famous and outstanding scientists long before the revolution.

Dr. WIGNER. They had famous people but what they have succeeded so well in doing is making science flexible and adaptable to their needs. In other words, they have succeeded in putting science into the service of their Government and to the service for increasing their national power to a much greater extent than we have. The progress of Russian science is spectacular, unquestionably, but it is not at all unparalleled and the progress in science in many other countries has been quite comparable, and in particular in this country.

I remember when I came to this country science was essentially a neglected field. Now we are out in front but we are out in front in pure science whereas the Russians, while strong in pure science, are perhaps more nearly out in front in applied science.

Senator JACKSON. By excelling in pure science we have made available that information all over the world and in some areas of the world it saved them from doing a certain amount of work, has it not?

Dr. WIGNER. Very, very much so.

Senator JACKSON. I believe you tried to make that point and you did in your remarks. The Soviets have taken that basic, scientific knowledge and applied it in the areas that would be most useful to them in developing power in the broadest sense of that term.

Dr. WIGNER. That is so, Senator Jackson, but we should not disregard of course the fact that they have been making very considerable progress also in pure science.

Senator JACKSON. They have outstanding physicists such as Peter Kapitsa. There is a long list of them who are first rate, would you not say?

Dr. WIGNER. First rate indeed.

I can think of three in particular who were all first-rate scientists. Three of these were trained in the pre-Communist time which shows that they always had good science. The Communist system has supported this wholeheartedy and has supported it not only where it increases its power and might but also in general. We should emphasize this point: They have supported pure science also wholeheartedly in

many cases with utmost vigor; but they have also supported wholeheartedly applied science and they did not permit it to be pushed into the background.

Senator JACKSON. Is it not a fact that they have made concessions in their totalitarian system to the scientific community, concessions of freedom to a point, giving them greater latitude, greater recognition, and so on.

Dr. WIGNER. One suspects that there are several of the scientists who would not be free if they were not scientists.

Senator JACKSON. The Russians have found freedom a useful device to be made available to the scientific community in Russia in limited doses where it will do the most good.

Dr. WIGNER. Yes; and I think in some ways we should learn from them. If we have a Communist on the faculty, we should not push him out. He may be wonderful in teaching physics, for instance, and I very much doubt that he will convert anyone to communism. The fact that he is a Communist should not make us dispense with his services as a teacher.

Senator JACKSON. As long as he keeps teaching——

Dr. WIGNER. Only physics or mathematics.

Senator JACKSON. You feel that Marxism has not been able to revise the laws of mathematics and physics yet?

Dr. WIGNER. I am afraid mathematics and physics are more than they can convert to the cherished beliefs of the Marxists.

Senator JACKSON. Do you feel that the Communists have to bow to the laws of physics every now and then and they find it useful to do so?

Dr. WIGNER. Yes; they find it useful to do so.

Senator JACKSON. I was particularly interested in your comments, Dr. Wigner, about the importance of exchange and cooperation with our Western friends and allies. I presume you refer in large part to Western Europe.

Dr. WIGNER. To Western Europe; yes, sir.

Senator JACKSON. As you know, some of us have been active in promoting fellowship programs, within the NATO community. We have tried to suggest that there be even a more closely working relationship within that community among the scientists. Is it not true that we could avoid a lot of duplication, we could achieve certain objectives faster by utilizing some of the fine talent in that great community with which we are closely associated?

Dr. WIGNER. I have heard innumerable very favorable comments on the NATO fellowships and also on the contracts which the Naval Research Laboratory has given in France, in Israel, and in England as well as Belgium. They were extremely useful but they were extremely useful principally in fostering good will and collaboration. I do not know whether it is possible or even desirable to plan pure science so as to avoid duplication, and I do not think that these fellowships and projects, useful as they are and important as they are, really do accomplish this purpose.

If we speak about avoiding duplication, we should think mainly of applied science which we are more nearly in a position to orient and direct. It very often happens that a field of research is supported strongly by the Government and a similar situation exists in Europe.

They accomplish some marked success in one field. Well, we jump into it. I think that is unnecessary. We should try to develop what we have started and let them develop what they have started. I think particularly of nuclear reactors. I think we could avoid a good deal of duplication that way.

The fellowship programs are very useful and create an extremely powerful bond between the countries but generally I feel our shortages will not be relieved that way. Similarly, a fellow coming to visit our country does not relieve our shortages.

I had occasion more recently to see what unbelievable difficulties our smaller colleges experience in finding adequate teaching staffs. Of course, it is very difficult to find some one in another country who can really jump in and give a course on freshman physics at a small college. However, if we bring them to this country first in the capacity of assistants or some similar capacity, I think they will grow into our system and they will become useful members of our educational and applied science system.

From all that I have seen, we can trust them just as much as we can trust our own citizens. This country has the very fortunate ability to be able to acquire the loyalty of relatively new immigrants to an almost phenomenal degree.

Senator JACKSON. At that point, could you elaborate on the number of people who were at the top level in the Manhattan project who were not born in this country and who made a substantial contribution?

Dr. WIGNER. It must be admitted that the number was substantial and partly because many of our American born colleagues were put into other projects earlier, so that many of us foreign-born scientists remained available at the time when other projects were already well on their way. Just the same, the number to which you have referred is quite impressive and includes, of course, Fermi, Szilard, Teller, Bethe, and a number of others.

Senator JACKSON. And it included Niels Bohr, later in the project. I believe he was smuggled out of Denmark.

Dr. WIGNER. He was smuggled out of Denmark. He had a more distant relationship and on less of a working level.

Senator JACKSON. Then there was a large number of scientists from England, Dr. Penney, among others.

Dr. WIGNER. Yes, sir. There the collaboration was truly wholehearted. In fact, we reaped more benefits from it than the British—much more.

Senator JACKSON. The British made an enormous contribution to the Manhattan project, did they not?

Dr. WIGNER. An enormous and wholehearted contribution to the Manhattan project.

Senator JACKSON. Would you not say, therefore, that the Manhattan Project was an outstanding example of cooperation among a group of scientists who came from many different lands as well as our own?

Dr. WIGNER. Indeed that was so. Unfortunately it is true that it was made possible partly by virtue of the fact that many people believed it would not lead to anything and it is easier to agree to wholehearted cooperation if you do not believe it is going to lead anywhere.

Senator JACKSON. You feel, then, that if you feel you are going nowhere you feel you can get more steam that way.

Dr. WIGNER. That is right.

Senator JACKSON. I think we have sometimes operated that way and still we have had problems.

Senator BUSH. I was interested in your discussion about the Manhattan project. I felt that that was an illustration of how an enormously important project could be conducted and because of the tremendous importance of the national safety and the national security, it was conducted on a secret basis and I think it is one of the outstanding examples of what can be done when the national security is involved. I think of it now because I have felt myself in the past year or so there have been so many compulsions of a political nature upon our military to disclose important data, that it has had a deleterious effect upon our position, and it has even been somewhat dangerous. I know some members of the Joint Chiefs of Staff have testified right here in meetings like this that they were deeply concerned about that, and I have always felt that the Manhattan project was a good example of what could and should be done when you are dealing with matters that are of such importance to the national security. Do you not think that is so?

Dr. WIGNER. Indeed so. However, at that time the program also had the wholehearted cooperation of the press, and this is now a very, very difficult problem. The situation now is if somebody leaks some information to the press and it becomes public, nothing can be done about it. I doubt that this situation is a tenable one.

Senator BUSH. I notice in your remarks you commented about our tendency to tell the world everything about our strength and position and I was glad to see that cautionary note in your comment. I feel exactly that way about it myself.

I think you have delivered a fine paper here, Doctor. I have full admiration for this paper.

You pointed out some things that needed to be pointed out and I hope a lot of attention will be paid to what you have said here this morning.

I am particularly pleased to hear someone of your standing in science say we are strong and as of now our leadership has not been effectively challenged.

I do not think many believe or understand that is so. I believe coming from you that is good news.

I also applaud your caution against trying to have a finger or even a fist in every pie. I do think we have had that tendency and I recognize your caution that we cut the cloth to fit our own suit; that we approach the scientific problems and develop the products to our needs and for our defense and for our cooperative defense of the free world. This is very, very important.

I am glad you have emphasized that.

I am glad too that you mentioned that the recovery under our system was accomplished much more rapidly with infinitely less suffering. I do not believe people have recognized that.

It suggests that we not proclaim too much our own virtues; that we should be more interested in proclaiming the virtues of others rather

than proclaiming the inadequacy of their superiority when an occasional illustration of that kind presents itself.

I regret that I have to leave. I am not a member of this committee, but the chairman most graciously invited me to attend these meetings. I want to say that I think you have made a very significant contribution to our thought here and to the work of this committee and I congratulate you.

Dr. WIGNER. Thank you.

Senator JACKSON. Thank you, Senator Bush.

Senator Muskie?

Senator MUSKIE. I want to add my compliments to those you have already received on this fine statement this morning.

The first question I have for the purpose of clarifying my own understanding of what you have had to say, relates to this statement which you made. You say that the danger is very great, therefore, that U.S. science works for the whole world whereas Russian science works for the increase of their might.

I take it from what you have said elsewhere and from your recommendations that you consider this to be a danger which we must risk. You are not suggesting that we ought to do something less or that we ought not work for the whole world?

Dr. WIGNER. I am sorry, but I could not follow you completely there.

Senator MUSKIE. Perhaps I should repeat my question.

The quotation from your statement to which I referred was this:

> The danger is very great, therefore, that U.S. science works for the whole world whereas Russian science works for the increase of their might.

I take it from the tone of your statement and recommendations that you consider this to be a danger that we must risk. You are not suggesting that we ought to do less than this or that we ought to change our policy with respect to it.

Dr. WIGNER. To a certain extent, I think we should change our policy. I certainly would not recommend that we should not support pure science wholeheartedly and I certainly would not suggest that purely scientific results should be kept secret; no. We should support pure science strongly and wholeheartedly.

Senator MUSKIE. And there should be a free exchange of information and knowledge in this field.

Dr. WIGNER. In pure science; yes. I am not too sure whether or not we have gone too far in divulging technological accomplishments. In particular, I was questioning—with very little knowledge—but I was questioning the wisdom of our having communicated our results on transistors so very, very fast. If we had waited 2 years, surely our own work on transistors would have suffered some, but the difference between the free world and the Communist system would have been greater.

I do not believe that the Russians show an equal generosity in communicating their results and much of what we learned from them even in pure science seems to have been extracted with pliers.

If you are interested, I could quote the fact that our knowledge of their accelerators until the first Geneva Conference was practicably nil, and accelerators are some of the prime tools of pure science.

Just a few weeks before the first Geneva Conference, they published about six papers which evidently were not written in those few weeks. In these papers, they told of very significant and very far-reaching results in high-energy physics. This is an indication that they do not consider it necessary to tell us about their results even in pure science at every point and very completely. They have told us many things, but apparently not everything.

Senator MUSKIE. Are there two sides to this problem of getting information as to Russian progress? Let me ask that question in the context of a personal experience.

I was in the Soviet Union last fall with members of the Senate subcommittee to study Soviet hydroelectric progress. In the course of our trip there, we accumulated a lot of Soviet scientific publications in this field, quite a number of them.

When we returned to this country, we thought we would make sure that all of these publications had been translated into English and we wanted to be instrumental in arranging for this in connection with any publications which had not. We were not under the impression that any of these documents were particularly secret. They were simply documents that we had accumulated.

We found that not one of them had been translated into English. Is this lack of alertness on our part depriving us of important information with respect to Russian progress not only in applied sciences but in pure science?

Dr. WIGNER. I think you have put your finger on a sore point. Very few of us American scientists speak Russian and many of us are so overworked that we do not find the time to read all Russian publications; not even those which are available and not even those which have been translated.

The Russian's situation is much better. I do not know how it is managed, but they are more familiar with our work than we are with their work. It is possible that their larger number helps them. It is possible that they are more widely familiar with English than we are with Russian. I agree with your point that not only is information not always available but even the information which is available is not always fully digested and utilized.

Senator MUSKIE. To go to another question that your observations have suggested, you suggest that our discoveries and our progress in applied science should not be made so freely available to the rest of the world, including the Soviet Union.

Now, who is to make the determination as to what information ought to be available?

Dr. WIGNER. Of course, I do not know but it seems to me that if there is a greater awareness of the problem, then, in the case of the Government work, the contracting agency can do something. As a matter of fact, I found in private companies a great deal of understanding for this problem, not universal understanding, but a great deal of understanding.

Senator MUSKIE. There appear to be only two alternative means of exercising the control you mention. One is self-imposed discipline on the part of the people who make these advances and, secondly, Government control. I take it you would be reluctant to make any move in the second direction?

Dr. WIGNER. I really don't know. It is very difficult to have something not divulged if many people know it and if there is no compulsion whatever against divulging it. Most discoveries are not made by a single person but by more or less large groups.

When transistors were manufactured, there were hundreds of people who had known about them and had made some sorts of experiments on them. I know I am making myself very unpopular with these statements.

Senator MUSKIE. There is a difference between the Manhattan project and what we are talking about now. The fact that this secret about the Manhattan project existed was an open secret and we were able to control it, but with respect to a given project under a given set of circumstances.

What we are talking about now is applying this type of secrecy now across the board in undisclosed ways and this is more dangerous.

Senator JACKSON. May I intervene right at this point? I had the impression, Dr. Wigner, from your statement that what you had in mind was a slowing down of the dissemination of the information in applied science.

Dr. WIGNER. That is right.

Senator JACKSON. You can see that it is inevitable that this must get out but we do not have to publish immediately to the world what our findings are before we produce something in quantity. Once production gets underway the world is on notice.

I believe your point in the case of transistors was to the effect that we could have slowed down the Russian competence in this field by maybe a couple of years if we had not accelerated the rate of dissemination of information.

Dr. WIGNER. That was the sense of my statement.

May I bring out another point, which is perhaps significant, that the first attempt to make the information which led to the Manhattan project secret came not from the Government but from some farsighted people, in particular, from Dr. Szilard. It was the scientists who recognized the desirability of some secrecy.

What we are after is, of course, the greatest freedom and quickest dissemination of information in every way, but I am getting a little doubtful that we accomplish this by giving out our information freely and not asking for anything in return.

Quite possibly, the free flow of information in every direction would be enhanced if we did not say, "Oh, we will give you everything regardless of whether you give us anything." The aim is and always will remain for every scientist to have free flow of information, but the question is how do we get to this most expeditiously?

Senator MUSKIE. I am glad that Senator Jackson interrupted because he stated what I understood to be your attitude on the whole problem. I do not suppose we can go much further in nailing down the means for controlling this.

I would like to point out, however, that in your recommendations, of course, you suggest in some respects a freer exchange of information on applied science on a more nearly reciprocal basis which is really a qualification.

Dr. WIGNER. Yes, and it is meant to be a qualification that we should try to obtain information from the other side approximately as freely as we give it. I do not think that this is an unreasonable suggestion.

Senator MUSKIE. Have you any feeling as to whether or not the Russians would be more inclined to offer information as to their technological advances more freely if a frontal approach were made to this problem?

Dr. WIGNER. Of course, if I can get oranges free on the market, I will not pay for them. If somebody gives me oranges only if I give him nickels for them, I will give the nickels for them.

Senator MUSKIE. I think you have put your finger on it.

Let me turn to another question. I was impressed, as was Senator Bush, with your point that we should be making a more selective and a more balanced approach to our efforts in all fields including the field of applied science. I think this statement of yours:

> In particular we should not continue to project a marginal value because of an outcry, "The Russians will get ahead of us."

It would seem to me you had something specific in mind and I wonder if you would be interested in disclosing what you had in mind.

Dr. WIGNER. What I described happens not infrequently, but the specific examples are not suited for detailed discussion because in every specific case one can argue a great deal and no specific case is clear cut.

Senator MUSKIE. Is that not the problem?

Dr. WIGNER. Yes, it is. But I do not like to see the situation that as soon as somebody says the Russians will get ahead of us, this cuts off further discussion. This is not a tenable situation.

Senator MUSKIE. I do not necessarily force this subject on you, but I wonder if you had in mind something like the competition between the different military services in the missile field. Is this something that you had in mind?

Dr. WIGNER. I am very unfamiliar with the missile program and I really do not know the situation there. I did not have the missile field in mind because I know so little about it.

Senator MUSKIE. In that, you are not alone.

I was interested in your suggestions for correcting manpower shortages in the scientific field. You made the statement somewhere that it is very difficult to find a first rate scientist in America in the applied science field. The only recommendation you made which has any bearing upon that is that we employ more scientists from overseas and from other countries.

Dr. WIGNER. That is a very anemic suggestion.

Senator MUSKIE. Do you have any suggestions as to how we might strike at the heart of the problem?

Senator JACKSON. When you said it was anemic suggestion, I am not so sure about that. Did you have in mind that by bringing in foreign scientists who are highly competent in the applied field we could save some time during this critical period when we need them until we can train more applied scientists or applied physicists or applied technologists?

Dr. WIGNER. That is part of it. I believe another suggestion which I made would also help. I know that very often when it is suggested that someone undertake a project, he is scared away because he has seen the many pressures, the many administrative difficulties which he would encounter. This comes under the heading of letting him start the program, give him time and money and leave him alone until

the day of reckoning comes. It is very uncomfortable to work under constant pressures when someone constantly comes to you and tells you exactly what to do or what not to do.

I think if we gave the scientists more freedom and let them use their own initiative more, we would find more of them attracted to applied science.

Senator MUSKIE. When I raised the question it was not for the purpose of criticizing your suggestion because I think all of your suggestions are excellent. I simply wanted to touch upon another subject which I did not think you intended to touch upon, to which you might have an answer for us.

It strikes me as strange that in this field we should have a shortage of "practical" skills, to use another word for applied, because America is a country that develops skills in the practical field. Why should we have difficulty here?

Dr. WIGNER. It is very puzzling, indeed. A partial explanation may be found in the fact that pure science is relatively new in America and every novelty has a great attraction and challenge. Pure science does present a challenge which is very difficult to parallel and it is very difficult if not impossible, to persuade a person who is interested in pure science to leave it alone and go and try to do something practical.

Just the same, we should do at least our best to encourage it and encourage applied science also. One of the ways of offering encouragement—and I realize it is incomplete—is to give these projects more standing and burden them with less interference. I am more in favor of having a day of reckoning when the scientist will have to say what he has accomplished. This is a challenge and not a brake.

Senator MUSKIE. Might the reasons for this shortage be similar to the reasons, for, say, the shortage of engineers?

Dr. WIGNER. Yes. Of course, there is also the question of our training of large numbers of people and training them adequately. I admit that I cannot propose a cure. All I have mentioned are measures which would alleviate the situation.

Senator MUSKIE. Last year a subcommittee of the Government Operations Committee conducted a survey on the feasibility of having a Department of Science. Legislation modifying that proposal was introduced but this proposition is still before the Congress. I wonder if this is something to which you have given any thought and to which you might have a reaction which might be of interest to us.

Dr. WIGNER. I cannot see how a Department of Science would function. This may be just a lack of imagination on my part, but the fact is that neither I, nor any of my friends, with whom I have discussed these questions can see clearly how a Department of Science would function in this country.

Most countries in Europe have a department of education which also is a department of science. It is in charge, however, of all the universities, all the institutes of technology. These are all state controlled in the countries to which I am referring and which includes Germany and France in particular.

We do not have any U.S. universities, we do not have any U.S. institutes of technology. All of our universities and institutes are either State administered or privately administered. I think they

function very well and it does not seem that there is a real need to change their administration. I think that a change of our system would lead to dislocations and problems which are unnecessary.

Senator MUSKIE. I think one of the arguments made for it last year was that such a department might contribute to raising the prestige of the work in the scientific fields particularly insofar as government activity may be involved.

Dr. WIGNER. I think the prestige of pure science is adequate and I do not know whether a real scientist needs so much prestige. I often think we have too much prestige. I think somebody who is sincerely interested in science will become a scientist even if he will not be able to parade in the first row.

Senator MUSKIE. May I suggest you are a prime illustration of that?

Dr. WIGNER. I have perhaps had more than my share of recognition and I appreciated it, but there is a need for recognition also in applied science. This country has every reason to excel in applied science. It was great in applied science much before it was great in pure science.

Senator MUSKIE. Thank you, Dr. Wigner.

Mr. PENDLETON. In your statement, you refer to our not being out in front on mission-oriented science. Could you explain what you mean by "mission-oriented science and technology"? Would the space probes and satellite efforts be in that field?

Dr. WIGNER. Yes; the production of satellites is very definitely in this field. We do with the satellites a great many things or we expect to do with the satellites a great many things which are pure science, but putting a satellite into an orbit is mission-oriented science. When the satellite is in orbit, it may be able to discover radiation of the sun in a frequency region which we cannot discover under the atmosphere. This would be a discovery in pure science.

In other words, the satellites launching and production is mission-oriented. Some of the use of the satellites, I hope, will yield important scientific results.

Mr. PENDLETON. What is your reaction to the scientific results so far from the space probe Pioneer V and the satellites Tiros and Transit?

Dr. WIGNER. I am delighted with our success with them. I am not familiar with the purely scientific results which Tiros so far has provided but I am very confident that I will in due course become familiar with them and they will be significant.

As I mentioned in my statement, even though our satellites are much smaller than the other satellites, they have provided the bulk of scientific information up to the present time.

Mr. PENDLETON. I have before me, Dr. Wigner, a column by Roscoe Drummond from the April 6 edition of the Washington Post. Mr. Drummond says:

> The scientific knowledge we are now gathering from outer space is becoming impressive. More dramatic achievements are in the making.
>
> In spectacular firsts—first sputnik, first lunik, first to photograph the unseen side of the moon, first to hit the moon, first to send an animal into space and retrieve it safely—the Soviet record is preeminent.
>
> In significant scientific results the U.S. space program is clearly outdistancing the Russians.

Do you agree with this?

Dr. WIGNER. If we know the Russian results, then I do. The most important scientific results from the space program were published by the United States.

Mr. PENDLETON. You are referring now to this problem of reciprocity in the dissemination of technical knowledge?

Dr. WIGNER. I just do not know what the actual facts are and I do not see how I can know, and I do not want to make statements on questions which I do not know.

Mr. PENDLETON. Without objection, Mr. Chairman, I would like to have the full article inserted in the record.

Senator JACKSON. Mr. Drummond is a fine newspaper writer, but he is not a scientist. However, we will include it.

(The newspaper article referred to follows:)

[Washington Post, Apr. 6, 1960]

OUTER SPACE BOX SCORE NO LONGER IS ONE SIDED

By Roscoe Drummond

Now that U.S. Pioneer V is continuing to send back its reports more than 3 million miles toward the sun and U.S. Tiros I is orbiting the earth observing the weather and transmitting its photographs, this is a good time to ask: How do we now stand with the Soviets in the race to outer space?

The factual answer, I think, is this:

In significant scientific results the U.S. space program is clearly outdistancing the Russians.

In spectacular firsts—first sputnik, first lunik, first to photograph the unseen side of the moon, first to hit the moon, first to send an animal into space and retrieve it safely—the Soviet record is preeminent.

U.S. space projects are beginning to move more rapidly. More launchings are coming soon and in the development of rocket thrust, where the Soviets have been far in the lead, the new Saturn launching vehicle, capable of 1½-million-pound thrust, can be ready in 1963, ahead of schedule, if Congress approves the funds.

Alongside the Soviet spectacular firsts, the United States is achieving some outstanding scientific firsts.

Tiros I, weighing 270 pounds and containing two long-range cameras and equipment capable of receiving instructions and transmitting data to ground stations, is the world's first weather eye in space. It circles the earth about every 90 minutes at an altitude averaging 450 miles. This is a marvelous, though elementary beginning. The next weather satellite will contain greatly improved instruments. The time will come when the weather forecaster will no longer be the butt of jokes because of his mistakes. When man can predict the weather scientifically, he may well be able to control it.

Pioneer V is another scientific first. It now appears probable that we shall be able to talk to it and get information back even when it is 50 million miles away. We are getting data on the temperature inside and outside of the satellite as it continues on its orbit toward the sun. It is also sending valuable information on the magnetic fields in outer space.

Altogether the United States has now launched 15 earth satellites of which 6 are still in orbit. The Soviets have successfully launched three, all of them much heavier than ours, of which one is still in orbit.

The United States has successfully launched four deep space probes. Two of them—Pioneer IV and V—substantially achieved their orbits. The Soviets have successfully launched three. Each achieved its principal objective, one orbiting the moon and another hitting the moon.

As to failures, ours have been publicized. The Soviets have kept theirs secret.

There are three reasons why our space program has lagged in "spectacular" firsts—and that adjective, spectacular, is used in admiration, not in criticism.

We were late in starting and we started timidly.

We tied our space program to the military missile program and when we found that militarily we did not need as powerful a launching thrust for the Atlas as first believed because we developed much lighter weight nuclear warheads, then there was no military reason for developing the kind of rocket best suited to explorations of outer space. We didn't develop it. The Soviets did.

For too long the administration tended to look at outer space through the wrong end of the telescope and hence failed to see until the Soviets were well in the lead, that Moscow would garner incalculable prestige if we allowed them to leap to the front in space exploration. We failed to see early enough that by being first in outer space the Soviets were advancing the cause of communism by demonstrating Soviet superiority on a very visible and dramatic front.

The scientific knowledge we are now gathering from outer space is becoming impressive. More dramatic achievements are in the making. We expect to put a man into nearby outer space this year and we are making solid headway in developing a rocket with a thrust of 6 to 12 million pounds capable of putting a man on the moon.

No longer is the box score on space one sided.

Senator JACKSON. Do you feel that authority should be delegated to a person in charge, a highly competent person, and should he be given full authority to do the job without being constantly interfered with?

Dr. WIGNER. That is exactly how I feel about it.

Senator JACKSON. Would you say Admiral Rickover's achievement of the nuclear submarine is a good example of what can be done in the way of applied technology when such an arrangement for delegation of authority is provided?

Dr. WIGNER. Definitely. That is one of the programs in which we seem to have been successful.

Senator JACKSON. And we have been first in this area?

Dr. WIGNER. As far as we know.

Senator JACKSON. That is true, so far as we know.

You have made it clear in answer to questions put by Senator Muskie that there is a need to step up our effort in applied sciences and technology. Would it be helpful to do more in the area of Federal aid in particular for teachers, in critical subjects of mathematics and physics? Do you have any opinions along that line, assuming that the States are not doing enough?

Dr. WIGNER. The summer programs have been extremely useful and very good.

Senator JACKSON. You are referring to the provisions in the Defense Education Act in which summer seminars have been arranged for courses being made available to high school teachers in physics and math?

Dr. WIGNER. They have been very useful and very effective. I think other similar measures would be very helpful also. Also a little persuasion to employ as physics and math teachers people who know physics and mathematics and not only education would also be very useful. However, this is apparently not within the competence of the Federal Government but within that of the State governments.

Senator JACKSON. Dr. Wigner, once again we want to thank you for your helpful contribution this morning. We particularly appreciate your very honest and candid replies to the questions and the presentation in general of your testimony.

Dr. WIGNER. Thank you for the opportunity, sir.

(The appendix to Dr. Wigner's statement follows:)

APPENDIX

Experimental Discoveries	*Theoretical Work*
Lamb shift and the electron's magnetic moment	Renormalization
Maser	Explanation of super conductivity
PARITY NON-CONSERVATION	
U.S.:	
Mesons and hyperons	Strangeness
Size and shape of nuclei	Nuclear shell model
Transistors	Dispersion relations
Pion and nucleon scattering	A-V interaction
New accelerators	Many body problem
Van Allen layer	
U.S.S.R.:	
Cerenkov radiation	Conserved current
Second sound	Theory of superfluidity
New accelerators	Analysis of general relativity
Elsewhere:	
Pinch	Collective model
Mossbauer effect	Dispersion relations
	TCP theorem
	Statistical theory

Senator JACKSON. Our next witness this morning is another physicist of world distinction, Dr. Edward Purcell, professor of physics at Harvard University. He played a key role in the development of radar in World War II and is a ranking authority on microwave phenomena, nuclear magnetism, and radio frequency spectroscopy.

He has served on the Air Force Science Advisory Board and is now a member of the President's Science Advisory Committee. In 1952 he received the Nobel Prize in physics for discoveries in nuclear magnetism.

Dr. Purcell, it is a real privilege to have you with us this morning. I believe you have a prepared statement.

STATEMENT OF EDWARD M. PURCELL, PROFESSOR OF PHYSICS, HARVARD UNIVERSITY

Dr. PURCELL. It is a rather short and rather general statement which I should like to read with some interpolations. Perhaps I should add that I am, of course, a scientist working outside of government, and a teacher. I have been connected on and off with Government problems for the past 18 years in various capacities, particularly the one the chairman mentioned, the Air Force Science Advisory Board and most recently the President's Scientific Advisory Committee. I have also worked on a number of ad hoc study projects.

I am not in any sense an expert on Government organization and the observations which I shall make on organizational problems are simply the result of a few practical experiences in a limited area.

Senator JACKSON. You may proceed in your own way and when you are finished with your opening statement we will ask questions.

Dr. PURCELL. Science is deeply involved in the security and in the welfare of our country. That is the overriding reason why the ad-

vancement and application of science is a concern of the Federal Government.

The importance of science for military technology has become obvious to everyone. That science was also the origin of our advanced industrial technology, whose benefits we take for granted, is not so well understood, but people do look toward science for the solution of problems of immediate human concern like disease. There is a growing awareness, too, that one element in the challenge of Communist societies—a serious and substantial element of the challenge—is their purposeful dedication to the development of science and technology across the whole spectrum from theoretical physics to agriculture.

From these considerations alone it is plain that the Federal Government has the responsibility to promote the most effective and rapid application of science to military defense, to encourage and support scientific contributions to the public welfare, and to maintain our national position in the forefront of science and technology.

But the job is even bigger, the horizon even wider. I am convinced that science can make a much greater contribution to the welfare and vitality of the free world than a simple projection of trends would suggest. Indeed, I believe that if we come close to living up to the potentiality of science and of our own intellectual resources, we shall find the strength and knowledge to cope with the most acute material and social needs of the coming decades and we shall be able to take on confidently any Communist competition.

So, the challenge, in the widest sense, is to make the most of our opportunities. The danger is that we may set our sights too low.

We ought not to look only to Government for leadership in setting these distant goals. That responsibility is shared, in a free society, by the whole scientific community. It is a task for all of us, including the departments of Government, to promote a public understanding of what science can mean for our future.

Now I turn to your practical questions about how we can best get on with this complicated enterprise in which the Federal Government is already so heavily engaged. What has to be done to insure effective application of science in the national service? Two things, at least, are absolutely necessary:

(1) Promotion of vigorous growth in the pure and applied sciences;

(2) Alert recognition of opportunities for application and—what is often more elusive—action to concentrate effort on the task.

The first mission depends on education and research. The Federal Government is necessarily committed to support research on a very wide scale; through the fellowship programs it is directly supporting the advanced education of scientists.

A point I would like to make in passing, a rather obvious one to anyone who has been connected with this kind of an enterprise is, that not only money but administrative wisdom is needed in a long term program of support for basic research.

One has to keep new knowledge and new ideas as the goal, not regular reports and administrative tidiness. For instance, immediately after the war the support of much research in the basic physical sciences was undertaken by the military departments, notably the

Office of Naval Research. Other departments had programs too. There was no very logical apportionment of projects, often no direct relation between a project and the mission of the supporting service. Notwithstanding this rather illogical and makeshift structure of Federal support, the program was remarkably fruitful. Our current lead in many fields can be traced directly to it. That was an example of imaginative and flexible administration which reminds us that a logically unified organization is not the only good apparatus—perhaps not always the best—for some functions.

Today we have in the National Science Foundation the proper instrument for Federal support of basic research in the physical sciences. It ought to continue to grow; it is the right kind of organization, and it has been doing a very good job.

The second function or mission, identification of a task and prompt effective organization to accomplish it, is one that organizational structure alone cannot bring about. But organizational structure can surely hinder it, either because the task fits no agency's conception of its own mission, or because several agencies can claim it and do, and have to be coordinated, or simply because a department's structure is too rigid to allow the right team to be pulled together for the job.

It seems to me the watchwords should be flexibility and task-oriented teamwork. I have no formula for accomplishing this and indeed, would be suspicious of any general administrative solution. The main thing is to find ways to give good men freedom to work directly together toward a challenging goal.

After these general remarks I should like to reply briefly to certain specific questions you have put.

One, long-term planning for science and technology, is an essential function of Government. We need to do more of it. We have to remember that the scientific breakthroughs defy prediction, but even if one cannot accurately project the development of science, it clarifies one's vision to try. Some trends and possibilities can be foreseen. And I believe one can make a valid projection of some very important national needs, to which science and technology can contribute decisively.

To illustrate the problem of looking ahead, I should like to recall an early attempt in this direction to which I was a party in the Science Advisory Board of the Air Force just after World War II. Under the leadership of Dr. von Karman, a document was prepared entitled, as I recall it, "Toward New Horizons." It attempted to chart the course that technology might take in the next decade or so and point out its relevance to the Air Force mission. It would make interesting reading now. I have not seen this report for many years, but I can guarantee you some things are not in there. Some of us had the job of writing the part of the report that should have predicted the transistor. No such prediction was made; the transistor hadn't been invented yet.

Despite such failures of clairvoyance, I believe it was the experience of the Air Force subsequently that that report did play a significant role in stimulating their thinking, in keeping them looking ahead and more or less roughly outlining the shape of things to come.

This is the job one has to do over and over again. I think the Government should call on the National Science Foundation and the Na-

tional Academy of Science for help in generating the long-range visions and plans. The subject is certainly one that the President's Advisory Committee ought to examine from time to time and one that ought to be in the background of much of their deliberations. It is indeed in the background of their deliberations in my experience. I do not think, however, the Advisory Committee can alone make a blueprint for the scientific future of this country. This has to be done by summoning all of our resources through the Academy and the Science Foundation. Blueprint is a poor word to use in that connection, of course. What we are trying to do is see what the opportunities might be in order to be able to capitalize on them.

You have asked about how we can do a better job of coordinating scientific and technical activities now scattered through many agencies. I have only a brief and not very helpful comment on that.

First of all, the fact that there are a bewildering variety of scientific and technical activities related to national security scattered through many agencies is a perfectly natural situation and one that is here to stay. It does not make any sense to gather all such activities into one department. We are going to have to continue to have alert coordination.

In critical cases, the President's Science Advisory Committee has helped and should stand ready to do so in the future. I do not think it can assume any routine responsibility for coordination nor do I think it should. It was, in fact, precisely the recognition of this need by the departments themselves and by the President's Science Advisory Committee that led to the recent formation of the Federal Council for Science and Technology, which is an instrument to do this task. I think it is too early to say how well it is working but the need was recognized and action was taken to do something about it. I think you have to keep improving your tools and strategy in this area every year.

Your third question relates directly to the President's Science Advisory Committee and asks whether it would be wise and desirable to give it some kind of statutory position. I believe the President's Science Advisory Committee on which I have worked for 3 years has been effective and useful and I would even say indispensable. I think its unique and important function will persist through any administration if only because of the very nature of the technical issues the Government is bound to face.

I, therefore, believe that statutory recognition of its role would be desirable. Its usefulness, of course, will always depend on the people in it and on the relationship the President chooses to establish with it.

The next question returns to a point upon which I have already commented, the problem of identifying technological opportunities for action. I am not satisfied that we do have a good way of doing this in all cases and, as I have said, I have no specific organizational remedy to propose. Broadly speaking, I think we need more flexibility, the ability to create a team which may have to be drawn from different agencies for one task, even from different institutions outside of Government and combined into a team.

What one can accomplish under those ground rules, I think, is astonishing, and you all know the cases where we have pulled together the big teams and what has been done.

I would like again to go back to very ancient history to cite one very small example in my own experience of this kind of problem. It is so small that it will not have any repercussions on present issues. I think it was in 1951 that a group was formed at MIT to work for the State Department and try to do something about the problem of the Voice of America, getting it through the Russian jamming.

We formed a small task force to work on this problem and I was in charge of the technical half of the operation. We beat our heads against the wall to figure out what we could do to get signals through. I am not sure that in the end we did very much to strengthen the Voice of America in signal strength. We did, however, as a by-product, run onto something else and it came about in the following way:

Some of the people who had been involved in radio wave propagation picked up an idea, suggested by someone, that you might be able to communicate over the horizon where radio waves would not ordinarily go, by taking advantage of natural irregularities in the high atmosphere. At the moment, this looked to us as one key point in the problem of the VOA, which had to get its program over to the continent in the first place in order to have it rebroadcast.

We thought we were justified in looking into the possibility. In the space of about, I should say, 24 or 36 hours by the use of the long-distance telephone, knowing scientists here and there, getting the right decisions here in Washington, we pulled together a small experimental operation which involved the National Bureau of Standards, the Navy Department, which loaned us a transmitter, the State Department, who was sponsoring the project, and scientists from other organizations. In a matter of weeks the experiment was on the air, and the signals came through.

Although it did not help the VOA as it turned out, it did lead the present system of communication on many long-distance circuits of critical military importance.

We were able to move fast in that particular case because there were no administrative or departmental barriers toward pulling a few knowledgeable people together to do a particular job that had to be done and there was wisdom shown all around in people that we talked to including the people in the Navy Department and the Department of State.

So, you can do it on an ad hoc basis, I have seen a number of examples of that. The real question is whether there is a more general solution than this ad hoc business, and here I frankly am not sure.

I do not wish to comment on the problem of coordination in the Department of Defense except to say that I believe the centralization of responsibility for broad technical decisions in the Office of Director of Research and Engineering was an exceedingly important and beneficial step. Whether further evolution of that structure is desirable and in what direction, I am simply not prepared to say from my own experience.

Finally, referring to your question about scientific manpower, I should like to comment on two quite different problems. First, in the top advisory committees, particularly the President's Advisory Committee as an example, one has to cover a broad range clear from pure science to engineering and on into industrial technology. It is

often hard to get the men the country ought to have in these posts in that last category—that is, engineers from industry. It is hard partly because of the fear of a conflict-of-interest situation. Possibly there is some legislative remedy for this particular handicap and I hope you will give some attention to it.

A second problem I will mention has to do with bringing the younger generations of scientists into the Government, of training a newer group of scientific advisers before the rest of us wear out or go stale. I cannot think of any legislative device to assist in this task. The President's Advisory Committee is acutely aware of it and is working in this direction.

Turning to the much broader question of scientists in Government, I think it is clear that we have to make a Government career more attractive for the research scientists. This is not merely a matter of compensation, but also—and most importantly—of freedom and support for long-term pursuit of distant research goals. Year-by-year design of scientific research by budgetary instruments hampers progress in basic science anywhere inside Government and out.

That is the end of my prepared statement.

Senator JACKSON. Thank you, Dr. Purcell. We appreciate the thoughtful time and effort that you have applied to the various questions that we sent to you.

First of all, to start toward the tail end of your statement, I wonder if I might ask a couple of additional questions in connection with the recruitment of scientific personnel.

Assuming that changes are made in the conflict-of-interest statute—which I hope will occur before long—still I must say that that remedy is a negative one. It merely moved certain barriers that were established years ago. I would like to turn to another part of the problem. Do you think it would be helpful if some kind of legislative authorization could be obtained which would authorize important departments of the Government to enter into contracts with universities, nonprofit corporations and private corporations for profit in which arrangements could be made to obtain key personnel in science, pure science, applied science, whatever might be necessary to obtain such people, for periods of time necessary to do important projects in Government in which the rights of the employee could be preserved, the interest of the Government could be properly protected and at the same time the interests of the university, the nonprofit corporation, and the private corporations likewise could be protected?

Dr. PURCELL. I think that might well be a useful step in some cases. There is this inbetween kind of service which this proposal, as I take it, would be pointed at; namely, that you can get people to come to Washington once a month or even once a week to give advice and to intimately learn a particular department's problems, but what we need is a way of getting people for longer, continuous service, and that is the thing I take it your proposal would be directed at.

Senator JACKSON. That is right. It would be a recognition of the fact that there are outstanding people in universities, in private companies, in nonprofit corporations that it would be impossible for the Government to employ on a career basis.

In other words, what I am suggesting is that if we are in a long-term period of challenge by the Sino-Soviet bloc that may involve 25

or 50 years, is it not the better part of wisdom to utilize and to marshal the best talent that we have in this country wherever we may find them on the projects that are indeed crucial and essential?

Dr. PURCELL. Yes. It seems to me the proposal has particular merit from the point of view of getting people in from industry.

In the case of people in universities, their sacrifice is largely a career sacrifice. It is a great deal to ask of a man to take 3 or 4 years out of his life when he is a productive scientist because science moves so fast you can go back and find you have no career left.

In the case of the industrial people, I think we have an enormous resource of capable people who cannot now be properly used in Government.

Senator JACKSON. I appreciate having your favorable comments on this, and I bring this out because the American public does not realize how handicapped we have been. As a matter of fact, if it had not been for the setting up of various nonprofit corporations and the utilization of our universities and the utilization of industry, we would not have been able to do the job in many critical areas.

Take one outstanding area, our whole atomic energy program. The great industrial corporations run our large production facilities both in the production of U–235 and plutonium. We call upon the University of California to operate two important laboratories, one at Los Alamos and one at Livermore. We pay these people salaries that we could not pay in the Government. In other words, we have had to indulge in certain devices, fictional devices, to get around statutory compensation situations. If it had not been for this kind of improvising, we would be in serious trouble, would we not?

Dr. PURCELL. I think so, very definitely.

Senator JACKSON. What I am suggesting is that we also recognize this as a fact but also recognize that we are in a long-term struggle with the Soviets, and if our free society with all of the advantages that go with free institutions must be utilized to the maximum, we certainly should not say that we are not going to make the effort because there are limitations in the procurement and the retainment of key people.

I might point out, too, that we have, Dr. Purcell, a situation now in which we are able to employ, through this circuitous device that I have just referred to, men of great talent. They make recommendations to people in Government who do not have the talent resources to pass on those recommendations. Is this not generally a fact?

Dr. PURCELL. Yes; this is a very real problem.

Senator JACKSON. I am not deprecating the fine career people we do have in Government, but I think it is generally recognized that we have to delegate a lot of the decisionmaking to these laboratories. We have to delegate them to various industrial sources because we do not have the resources within Government itself to make those decisions.

I was particularly pleased, too, with your favorable comment on the suggestion made in connection with the possible statutory recognition of the President's Advisory Committee. I agree with you that they have done an outstanding job and I think it would be a mistake if the new President failed to utilize this very helpful tool after January 20, 1961.

I take it from your testimony, Dr. Purcell, that you would like for the committee to continue in advisory capacity only. You do not want to put it into the operating business?

Dr. PURCELL. I do not think it should be in the operating business. I think as soon as it gets into the operating business, you will need another advisory committee.

Senator MUSKIE. May I add my appreciation to that of the chairman for your willingness to come and discuss this with us.

If I may review some of the statements you made, again for clarifying my own thinking, you are quite optimistic about the possibilities of science in the solution of social and other problems of our society and the contribution of science.

Dr. PURCELL. My feeling is there are important problems to which science can make a big contribution. This is not to say that there are not some other problems that have to be solved in other ways but let me give an example or two of what we can see as we look ahead. It seems to me pretty obvious that we have in this country a growing serious problem in public transportation which threatens the whole structure of our urban society. Well, what do you do about it? We are certainly going to have to do something about it within the next 20 years. Although we do not know the solution, I think it is clear that the solution will probably come along the technological route. For example, I think we will have to have a new type of portable energy source to solve this problem. At least it would offer one solution. If this is true, then one should be working long-range very hard on this particular problem which we are not, to my knowledge, doing at the present time because it is not seen as an immediate, acute problem. My own view is that we really do not take science and technology seriously enough as a means to cope with the problems that are upon us.

Senator MUSKIE. The objective of this committee is to insure that we do take science seriously. I gather from the whole tone of your testimony that you are skeptical about organizational answers to this problem, particularly governmental organizations?

Dr. PURCELL. To use a phrase that we use in science, they are necessary but not sufficient in most cases, in my opinion. I think organizational changes are very important. I think a wider understanding of the nature of the problem both inside and outside Government is at least as important. I think you have to approach some of these things task by task. When you have pulled off a very spectacular and splendid achievement, I think one should not be ashamed of that because it was done out of context and in a special way. Well, you have done it and you will do the next one the same way. The problem is to recognize the opportunity and get on with the job.

Senator MUSKIE. The very task of identifying the tasks is a difficult one.

Dr. PURCELL. Yes; but I think that is not quite as difficult as getting on with it. The task of sorting out wild ideas from ones that only look wild but aren't is a very difficult one, but in the end the hardest thing to do is get on with the job.

Senator MUSKIE. There is no organizational difficulty, in your opinion, in identifying the task?

Dr. PURCELL. Frankly, I do not know of any. We just have to keep on our toes all the way around.

Senator MUSKIE. We are just sort of disorganized rather than unorganized.

Dr. PURCELL. One has to be alert and this is one of the important things that a committee from the outside can look to so they can see the woods and not the trees. This is a function that advisory committees have performed and ideally should perform.

Senator MUSKIE. With no additional organization on a governmental level, at least in the scientific field, do you feel that in a free society that you just by the very nature of things get answers to pressing current problems?

Dr. PURCELL. No; I do not. You have to go after the answers.

Senator MUSKIE. There has to be some direction but you are reluctant to turn to centralized direction.

Dr. PURCELL. I am reluctant to put what I see as a problem of many facets with many different sides and calling for many different people, to try to put that all into one table of organization somehow, as you might do if you said let there be a department of science and all applications of science come under its purview.

I think this would be the wrong thing to do because of the variety of the tasks that we have to do. We have the life sciences which is a thing I have not spoken about because I am utterly incompetent in that area. There, science is applied to human welfare, but still there is overlapping because it is basic science with chemistry, biochemistry, and so on. I don't think there is any neat central structure which will by itself guarantee that we do not misunderstand in this enormously wide spectrum.

Senator MUSKIE. You agree, neverthless, that in some way we ought to be assured this essential scientific research and applied science will be done?

Dr. PURCELL. Yes.

Senator MUSKIE. Do you think our present efforts could stand some improvement?

Dr. PURCELL. Absolutely. Even if they were perfect now, which they are not, the problem keeps changing. For example, one of the jobs that the Federal Council might do—and it was one of the elements in the conception of that thing—they could look ahead so far as the Government departments were concerned several years and see what their needs for basic research were, the basic research which was relevant to their particular mission—the Department of Agriculture, the Department of Health, Education, and Welfare, the Department of the Interior, and so on. Whether that will work depends on the people involved and the freedom they have to think, the time they have to think in fact, whether they do have enough time to think about it, but that is one mechanism and we will probably have to invent more, and we certainly have an overriding need to make sure that we do not miss any important avenues here.

Senator MUSKIE. Thank you, Dr. Purcell.

Senator JACKSON. I just have the feeling, Dr. Purcell, as a layman, that with virtually all the departments of government being in research and development in one way or another that there is a substantial amount of compartmentalization. They almost operate in water-

tight compartments. It would seem to me we could make better use of our scientific resources within the Federal structure if there were some independent means of really knowing what is going on and to make sure that there is exchange of information. I know I have had it called to my attention on several occasions, especially where there is rivalry within the three services that information is withheld from the other service because it might have an adverse effect on their particular role or mission. I am just wondering if there is not some better way of getting at this structure. I have no way of knowing because I have not looked into it on a great scale. They are working counter to the kind of environment that a good scientist should operate in, with compartmentalization and avoidance of exchange of information which is so essential to the attainment of answers to critical problems.

In addition, I take it that it happens from time to time—you gave one illustration—you can be starting off on a certain objective and you may find an answer to a problem that you have no idea you would be able to solve. Is this a fair observation?

Dr. PURCELL. Yes. One thing that helps greatly is combined task operation. If you have to draw people in from different departments to work on a given task, that automatically catalyzes the exchange of information where it counts; namely, where the people are working together. Incidentally, I do not think isolation is always to be regarded with suspicion in matters like this. Science is a very demanding business and it takes your whole attention. The fact that there is a scientist in the room down the corridor working on a problem and not really knowing what the fellow at the other end of the corridor is doing is not necessarily bad.

Senator JACKSON. If you have an enormous laboratory in which the output from the laboratory——

Dr. PURCELL. That is the other extreme. There should certainly be no impediment to the flow of information where it is needed, but you can sort of coordinate people to death who are doing basic research. If a fellow has an idea, you may have to leave him alone for a while. You don't go around asking him "Have you read all of the literature on this and do you know what other people are doing on this?"

But we do have a continuing problem which is certainly going to get more serious. We just have to keep working on it.

Senator JACKSON. The President's Scientific Advisory Committee, I know, has been helpful in making surveys.

Dr. PURCELL. It is an enormous task. If you try to inform yourself about the scientific work in any of the departments, especially those with the vigorous programs, it is a big job.

Senator JACKSON. You run into the problem of the independence of the departments, do you not?

Dr. PURCELL. Yes.

Senator JACKSON. If anything is going to be done, it would seem to me it would have to be done at the top level, at the presidential level.

Dr. PURCELL. It has to be done by a nonoperating department. As soon as you have an operating department then it has a different relationship to the others.

Senator JACKSON. Do you have any comments about the role of science in the State Department, the importance of it, and anything that can be done to improve it?

Dr. PURCELL. I think they have a growing, important need for high level advice.

Senator MUSKIE. Putting a scientist into organizational structures is like putting blinders on a horse; would you say that?

Dr. PURCELL. It all depends on the man.

Mr. PENDLETON. Do you feel that the operation and planning in government science has been affected measurably by the establishment of the President's Advisory Committee, the Federal Council, and the recent informal arrangement in the Department of Defense for coordination between the scientific Assistant Secretaries by Dr. York?

Dr. PURCELL. My answer to that is "Yes." I have not yet seen much of the Federal Council's work because I have not been involved in that.

Mr. PENDLETON. Do you feel that the scientific community would want the Federal Government to set forth a 10- or 15-year plan for science and technology, or rather would the scientists prefer future flexibility to exploit breakthroughs as they occur?

Dr. PURCELL. I think any very specific, rigid plan would strike the scientific community as pretty absurd and it would not be worth much anyway. I do think the scientific community would respond enthusiastically to the notion that one should keep in mind the possibilities of science in relation to the public needs and keep flexible and maneuverable so you can take advantage of the opportunities as they arise.

Mr. PENDLETON. Thank you, Dr. Purcell, and thank you, Mr. Chairman.

Senator JACKSON. Thank you, Dr. Purcell. We are grateful to you for your contribution here this morning.

This afternoon we will resume and conclude this phase of our hearings on science and technology when we hear from Dr. Herbert F. York, Director of Defense Research and Engineering, at 2 p.m.

The subcommittee is now recessed until 2 o'clock this afternoon.

(Whereupon, at 12:30 p.m. the committee was recessed, to reconvene at 2 p.m. the same day.)

AFTERNOON SESSION

Senator JACKSON. The committee will come to order.

We are very pleased to resume this afternoon with Dr. Herbert F. York, Director of Defense Research and Engineering. Dr. York received his Ph. D. from the University of California; served as a physicist at California Radiation Laboratory; Director of the Livermore Laboratory; on the faculty, Physics Department, University of California; and immediately prior to his present assignment was chief scientists for the Advanced Research Project Agency, better known as ARPA.

He has served on the Air Force Science Advisory Board, Army Science Advisory Panel, and the President's Science Advisory Committee. He is a noted scientist and administrator; we are very pleased to hear from you this afternoon, Dr. York.

Suppose you start out in your own way and then we will ask some questions. You have, I believe, a brief opening statement that you wish to make.

STATEMENT OF DR. HERBERT F. YORK, DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

Dr. YORK. Mr. Chairman, I don't have any opening statement except to say that recognizing the importance of the subject of these hearings I am pleased to be here and answer any questions that you may wish to put to me.

Senator JACKSON. All right, sir. Suppose we start out first by referring to a process that has been with us for a long time and it has been one I think of some trouble to administrators in the Government of all administration, the budget process.

I wonder if you have any comment as it affects your field as it works at the present time, if you have any suggestions for improvement, particularly in reference to your operation.

Dr. YORK. That is a very big subject and, of course, a very important one. I mean the budgeting of available resources in the end is one of the major factors that determines what it is we are going to do. Additionally, of course, the other kinds of resources, such as resources of people, particularly good people, also have major influence. The competition between the various kinds of things within the Department of Defense that money has to go for is something that has to be very seriously considered and takes a very large part of our attention.

Budget problems in the broadest sense take probably the largest single part of our time of all the things we have deal with. As for improvements, I don't have any really worthwhile suggestions, I am afraid. I have been in my present job and with the Government about long enough to know what some of the problems are, but not really quite long enough to have thought of all the answers as to how to take care of them.

One suggestion that is frequently made, and one which does appeal to me, is the idea of a longer budget cycle than the present 1-year budget cycle. Even this has its pitfalls. It is the fact of the 1-year budget cycle that forces people to make decisions and make reconsiderations of things that might be put off if there were no requirement for a 1-year budget cycle.

Putting both of these factors together, though, I think that we would be helped by a longer budget cycle than the one we have.

Senator JACKSON. May I read this comment to you from page 37 of our hearings on which Mr. Lovett in testifying before the committee addressed some comments to the subject of the budget:

> Mr. LOVETT. Mr. Chairman, I think there are two fields that I feel reasonably confident in expressing an opinion about. The first of those is that I think that the 1-year budget system is inadequate in many cases and in a sense is detrimental to both the congressional and executive branches in their attempt to make a policy effective.
>
> I think that in any experimental development program involving research and the awkward period during translation of research into an actual item, funding it for 1 year is unrealistic. I think we need to have something longer in order not to have to reset sights and suffer the vacillation which ensues.
>
> One of the most painful things that an executive goes through in the Government departments is the change of program while you are right in the middle

of it. You lose momentum and you delay the output. So I would say we need some form of budgeting for certainly half of the period of gestation of any new weapon, which used to be in the order of 5, 6, or 7 years—about 5 years to take the low side.

That would mean, say, 2 to 3 years of funding for some approved experimental research and development purpose. That would be the first area.

Do you feel there might be some merit in giving consideration to this approach that Mr. Lovett suggested, which of course, as you know, stems from rather long experience?

Dr. YORK. Much longer than mine.

Senator JACKSON. I realize that, but you have had the advantage too of being a distinguished scientist and you ran a large laboratory at Livermore very efficiently, very effectively, and made great contributions.

Dr. YORK. From the point of view of running a program at almost any level the annual budget cycle is, to say the least, a considerable nuisance. There are uncertainties about what next year is going to be. I might say, though, that in any good program the people who are in charge know that this is not a total uncertainty. I mean if you were to ask anybody who is running any of our programs whether he expects to get money next year he would always say yes. However, there is a certain amount of uncertainty with regard to just how much and what it is you are going to be able to do.

The other factor is that it takes such a very large portion of everyone's time. Trying to make things work out, trying to make things total up as they should, is something that takes a very large part of every administrator's time at every level, and it is one of the many things that forces recurrent reviews of programs.

As I said earlier, this reviewing programs is something that has to be done; and on the other side of the coin, and something that one would have to take a close look at, is the fact that as a practical matter the people in charge, if required to produce a budget only every 5 years, might not do such a good job of reviewing things as really needs to be done. Also, there are changes necessary as one goes along.

There are certainly new ideas that come up and the funds for some of these new ideas, of course, can be new funds. But, in a great many cases, because the economy is finite, it is necessary to find funds for new ideas by eliminating projects which for one reason or another are not as valuable as they were thought to be when they were started; that is, projects that events have bypassed, projects in which difficulties have been encountered, and so on. It is very important to review these new ideas. One of the stimuli for reviewing them is to find the funds from those projects to fund the new ideas that do come along. A great many new ideas would come along, say, in a 5-year period. If you had the right people doing these reviews at all levels, that wouldn't be a problem. The budget cycle does contribute to forcing people to make reviews which otherwise they might be willing to bypass in order to take the easy way out.

On the whole I think it is a good idea to fund things over longer periods than 1 year. Even so I just point out that there are some problems on the other side here. In some cases, as in the case of small basic research projects, it is possible today to arrange for longevity funding. It is not the rule, even in small projects, and it applies

at the present time only to small projects. It would be desirable to expand use of longevity funding very considerably.

Senator JACKSON. I am sure that there are some desirable features such as you have mentioned of keeping an eye on the expenditure of funds, but I just wondered if there was any particular magic in the 12-month calendar. We have had some very difficult undertakings. I am referring to, of course, some of these crucial R. & D. projects where under our system there have been ups and downs. Mr. Lovett had that problem in a previous administration. Then, too, there has been the comment, and you touched on the fringes of it, of the time that is involved in the budget process.

Officers who are involved in important work I would hope would be able to have more time available to spend on the crucial things instead of wrestling with the budget they are living under, the budget that they are justifying currently for the next fiscal year, and then preparing for the one after that.

Dr. Perkins alluded to that the other day, the three budgets that you are wrestling with. On top of that you have this funding process, having gone through all of the mechanisms that one must go through to obtain budget approval for presentation to Congress, and then when you get it from the Congress you have to go back somewhat the same route again, do you not?

Dr. YORK. Yes. It is not done when the appropriation bill is passed, that's right. The budgeting job is not done when the appropriation bill is passed.

Senator JACKSON. It is a never-ending process almost.

Dr. YORK. Yes.

Senator JACKSON. What this committee is desirous of doing, Dr. York, is to see if there are areas where we can make this procedure less cumbersome and yet have some physical safeguards.

It was in that connection that I was interested in having any comments that you might wish to make regarding improvements in the process.

Dr. YORK. My basic comment is that it would be helpful to be able to lengthen the cycle, but that in doing so one is going to have to be cautious that people don't use this as an excuse or means for avoiding difficult decisions that otherwise they are forced to make.

Senator JACKSON. Yes. Let me ask you one other question that I run across, at least in connection with my work in the Joint Committee on Atomic Energy, to be specific. Do you feel that the Bureau of the Budget has sufficient technical staff to really evaluate projects that are of a technical nature, especially in the research and development field?

Dr. YORK. I think it is probably better that the Bureau of the Budget not have a technical staff as such but to rely on technical people within the departments to come up with the answers for that department and, if necessary, the White House's own group, the President's Science Advisory Committee. The Bureau of the Budget has a role in reviewing projects to determine whether they are correct from the point of view of certain legal, administrative, and organizational considerations; and whether they overlap or duplicate important things which are going on in other departments and therefore which should be pulled together at a still higher level; and in

assisting the President to come to his necessary conclusions with regard to the overall budget. But I don't believe that technical decisions should be made in the Bureau of the Budget, and if they had much of a technical capability that would encourage them to do so.

Senator JACKSON. If they had a lot of technical capability you could utilize some of the top ones, couldn't you?

Dr. YORK. You could indeed. We can always use some more.

Senator JACKSON. I certainly agree with your statement. I don't see why the Bureau of the Budget should get into duplication of technical effort and I think your analysis is a sound one. We have had this problem a couple of time in the Joint Committee on Atomic Energy, where decisions have been made supposedly on technical points in the Bureau of the Budget, and I say this is a problem that has existed as far as the Bureau of the Budget is concerned under all administrations.

Dr. YORK. Yes. I think all technical people in all types of organizations always have their problems with the comptrollers and budget directors of those organizations, whether it is the U.S. Government or whether it is the John Doe Laboratory, Inc. I do have my occasional problems and disputes with the Bureau of the Budget, but it is not my experience that they do make very many technical decisions. They do make decisions that relate to technical problems, but these are usually because they have found some fiscal or legal reason related to some law or some Executive order, as the case may be, that makes the particular procedure that people want to apply improper.

It is all very well to complain about the kind of review the Bureau of the Budget sometimes makes, and I complain about it myself; but, the record is that very frequently they do discover important errors and mistakes in what has been put to them. The way to correct any situations where they may be overexercising their authority or looking into detail is for the level that produces the detail to turn out work in which there is no major error for the Bureau of the Budget to find.

Senator JACKSON. What you are saying is that they shouldn't make technical policy decisions; they should administer a program set down by the President which he has agreed should be carried out and within that framework it is their job to see that it is carried out?

Dr. YORK. That is right.

Senator JACKSON. But the technical decisions regarding a certain project should be left to the departments that are technically competent to make that decision?

Dr. YORK. They shouldn't make them, I think. Perhaps they do on occasion, but much less often than some people would indicate.

Senator JACKSON. You mentioned people here and I wonder if you have any comments, Dr. York, about the problem of, first, recruitment of good people, people of technical competence and people with broad experience, for important assignments in Government. This has been a never-ending problem all down through the years and I wonder if you might have a suggestion.

Dr. YORK. Yes, and it still is. It is a problem that I have had to face personally in the last year and a half. We need good people and we need them at all levels, and there is a problem in getting them also at all levels. Actually, I think in some ways there is less of a problem

at the top levels in the Office of the Secretary of Defense than there is at some of the lower positions. We need a variety of people. They all need to be good, but there is more to it than just saying you need good people. You need people who have the necessary experience to do the job and there are subdivisions to what one means by the necessary experience.

You need people who are experienced in Government procedures, and you also need people who are experienced in actually carrying out big projects, and you need people who have experience and training in technical details also. What you need are people of all these types.

Senator JACKSON. First, would you also comment in that connection about getting people for fairly long periods of time in some instances, and others for shorter periods? This becomes a problem.

Dr. YORK. That involves part of what I had said earlier, that one needs experience with regard to how the Government works and one also needs experience in actually directing large projects from positions fairly close to the work itself. In order to have experience of the first types, one has to be a permanent, or essentially a permanent, employee of the Government, so it is necessary for offices like mine to have a considerable part of the staff, including an important segment of the top staff, composed of permanent Government civil service, and to have these men in turn have the other qualities desirable, namely, technical knowledge in some detail and be generally good men. In addition it is necessary to have a certain number of people of the second type who are experienced, who have had relatively recent experience in the field.

This experience could be obtained in working for a Government laboratory, or it could be someone with an industrial background who has had recent experience in actually executing large and advanced projects. When you first get them they naturally come without any experience in broad governmental matters. It would be desirable if somehow you could get a man who had just been working in a large project, but at the same time he had had a good experience in the Government in the past.

Normally, you can't do that. It means that what you have to do is get people to come with fresh outside experience and hope that then they will stay long enough so that they can also build up personal knowledge and experience with regard to how to do things within the Government. Rapid turnover is one of the most serious problems I think we have.

Again this applies largely to the very top levels, the Presidential appointment levels. The average length of time a person holds his job, and this is not a new problem, is not really long enough to develop expertise at doing what needs to be done.

Senator JACKSON. As you know, the House Judiciary Committee has held hearings—I don't know what testimony actually they have taken—in connection with amendments to the conflict-of-interest statutes. I personally felt this is long overdue. It represents, however, the removal of certain negative barriers. I wonder if you feel this isn't a useful move: to update the statutes that I think were first passed almost 100 years ago.

Dr. YORK. In my own experience at recruiting, the problem of conflict of interest, or potential conflict of interest, or even possible appearance of conflict of interest without any reality behind it, is one of the most serious problems I have had to face in connection with getting people. A very large number are not available or cannot be brought in because of these problems.

In Defense Research and Engineering most of the work on big projects is being done, as we all know, by industrial groups.

Senator JACKSON. We have to contract a lot of it.

Dr. YORK. A great majority of our big development programs have been contracted out and therefore a very large percentage of the ablest project engineer and project manager type people in the United States are in the industries that are doing defense work.

Senator JACKSON. Don't you feel that the Federal Government at least should not be denied talent which it cannot now get because of problems in connection with the conflict-of-interest statutes because of the various personal reasons that exist in connection with the career that a given individual may have developed in which he has certain proprietary rights, including stock options, and pension rights, and a long list of rights that he would forfeit right in the prime of his career if he goes to work for the Government?

Dr. YORK. My answer is "Yes."

Senator JACKSON. Then I want to put the next question to you. I have a list of general informal suggestions I have tried out on a few witnesses, and one is that Congress should enact appropriate legislation and should make it possible for the appropriate departments of Government to contract with universities, nonprofit corporations, and private corporations for profit to work out by contract, an employment arrangement whereby some of these top people could work for the Government and at the same time those rights that I just referred to would be preserved.

The public interest would be protected and at the same time these companies, colleges, and nonprofit corporations would be saved embarrassment from allegations of conflict of interest and all sorts of unfavorable publicity that can come, as a result of sometimes even vague provisions in a statute. This is merely a rough idea.

Dr. YORK. I am not quite sure what you mean, Mr. Chairman, but wo do quite a bit of contracting with largely nonprofit institutions.

Senator JACKSON. No; I am talking about contracting for the employment of people from those institutions to work directly in the Government.

Dr. YORK. To work directly in the Government?

Senator JACKSON. Yes; not to give them a contract such as we have now with universities or with various corporations.

Dr. YORK. No; I didn't mean those groups. I meant groups such as RAND, such as the idea groups, and others who do operations analysis type work, weapon systems evaluation work, which does lead and aid almost directly in determining what it is that we should be doing in the way of further research and development.

Senator JACKSON. Dr. York, I am not suggesting we do away with those groups. What I am suggesting is that we are doing indirectly now what we can't do directly. In other words, if we want to get a job done we can't pay the salaries and we can't get the good people

that we need on a given project. Therefore we make a contract with a nonprofit corporation or with some industrial group to do a given job.

It would appear to me that we need to have at least some of these people in the Federal Government from time to time that we can't get because they are not about to give up a job which gives them certain vested rights, which in many instances, in order to comply with existing law, they have to forfeit. We run into this constantly.

Dr. YORK. Indeed we do.

Senator JACKSON. I am wondering whether or not we shouldn't recognize the fact that we are in a long-range struggle with the Sino-Soviet bloc, and in order to compete, and Mr. Khrushchev says it is peaceful competition that he wants, with this kind of competitor it would seem to me that the Federal Government should have the opportunity from time to time to have available to it the finest talent that it can obtain.

We are competing in so many critical fields where I just don't see how the Federal Government can do the job unless it can have available to it people who have the competency, regardless of what field they may be in, to do the job that the Federal Government must do. In other words, we concede that we have to do part of this and we are doing it now by various contractual arrangements.

Those institutions, organizations, entities, call them what you may, make recommendations, we will say, to your department in certain instances. You need to have competent people to pass on those recommendations.

Dr. YORK. If I understand you correctly, you are talking about much in the nature of what we are already doing in places like RAND, WSEG, Spake Technology Laboratory, and so on, brought one step closer to actual decisionmaking process.

Senator JACKSON. That is right.

Dr. YORK. Yes; it would be better if some way could be found.

Senator JACKSON. I am merely suggesting that we get some of these people directly. We are doing it indirectly now by setting up nonprofit organizations. The Air Force started this I think quite sometime ago with RAND. I think that was one of the first, back in 1945 or 1946. That job couldn't have been done within the framework of the Government.

Therefore, it does seem to me that we have had a long enough experience in this area that we could certainly afford to give to the Federal Government, not on an unlimited basis, but in the critical positions at the top, or in other positions that are not exactly the top, and yet are important, the kind of people that can really pass on some of these recommendations that must be made.

Otherwise for all practical purposes, especially in the technical areas, I would think, these contractors are making the decision and not the Government.

Dr. YORK. I might comment on that. There is a small step in that direction which we do find very useful. There is a statutory provision which enables the Department of Defense to have on its staff up to 10 people on a without-compensation basis. That means these people are paid by their parent companies. I am not adept at giving the precise legal language, but what it amounts to is that these people are

then by the statute, exempt from some of the usual conflict-of-interest laws, except insofar as the very company that they are being paid by is concerned. There are some further requirements, such as that they have to be employed by the company which continues their salary while they are in the Government.

They can't be suddenly employed by some one for the purpose of then paying them and sending them to work in the Department of Defense. We have made some use of this provision. As far as I know we have never had all 10 positions filled or being used, but even there there is always sufficient concern in the minds of many people that despite the fact that this is a perfectly legal procedure, somehow or other it won't look good to someone and that it is something to be used only in the most extreme and obvious cases.

However, that is perhaps a step in the direction you are speaking of and it has been a useful one, but it apparently requires more than that there just be a statute. It requires that somehow or other there be a general acceptance of the idea that this is basically good and necessary. The present statute doesn't even have quite that.

Senator JACKSON. I am familiar with that provision, but I do think to be completely fair about it that it may well leave the employee and his company in an uncertain state in case some one wants to, shall we say, take after them in public print and make all sorts of accusations that could be very unfair.

Dr. YORK. That is the problem, yes. It is used very charily even though it is there and available.

Senator JACKSON. Dr. York, let me ask you this. As you know, the week after next we are going to get into this question more in detail and I wonder if you would look with favor on an exploration of this area to see if a more suitable means by appropriate statutory legislation could be obtained to deal with this area, if you think it is of importance.

Dr. YORK. I look favorably upon an investigation into any means of making it easier to get more good men into Government positions.

Senator JACKSON. Don't you think this is one approach? I am not asking you to commit yourself to definitive terms.

Dr. YORK. I think it may very well be one good approach.

Senator JACKSON. And you couldn't very well get by with 10 slots in all of the Federal Government to carry out this kind of mission.

Dr. YORK. That is not very many.

Senator JACKSON. Not when you are dealing with a number of critical projects. Turning to your area again, if I may, we have provided by statute for an Assistant Secretary for Research and Development for the Navy and for the Air Force, but there is no such provision for the Army.

Dr. YORK. Correct me if I am wrong. I believe the statute provides for three assistant secretaries and left it to the service to decide what they should be assistant secretary for.

Senator JACKSON. I believe you are right on that. I revise my question.

Dr. YORK. And the Navy and the Air Force have chosen to use one of these slots in each case for an Assistant Secretary for Research and Development.

Senator JACKSON. Let me state it this way: We do not now have an Assistant Secretary for Research and Development in the Department of the Army.

Dr. YORK. That is right.

Senator JACKSON. Do you feel it would be useful to have such a position based on your experience.

Dr. YORK. It certainly has been a good thing in the Navy and the Air Force. Furthermore, the Department of Defense has had the position of that type for quite sometime. I think it has been a good thing there. I can't imagine any reason why it wouldn't be a good thing in the Army.

Senator JACKSON. I know two of the scientist engineers that you selected, for the Navy, Dr. Wakelin, and in the Air Force, Dr. Perkins are outstanding men. I just know of Dr. Morse, who is I believe chief scientist for the Army.

Dr. YORK. He is called Director of Research and Development.

Senator JACKSON. For the Army.

Dr. YORK. Yes, for the Army. It is a job at a level lower than that of Assistant Secretary. He has very much less authority than either Dr. Wakelin or Dr. Perkins. I am sure he could do his job more effectively if he had more.

Senator JACKSON. I want to compliment you on the caliber of men that are now in the department in research and development, I think they are first rate.

Now, if I might turn to one other area, how important do you think it is to have close coordination between your department, where critical R. & D. projects are being developed, and the State Department.

Dr. YORK. I think that coordination between these two is very important.

Senator JACKSON. In other words, in this modern day of weapons systems one has to treat the entire challenge as one overall problem in trying to evaluate the action that you must take in the development of a given project, is that not correct?

Dr. YORK. Yes. What is done in the Department of Defense has a very great bearing on the international position of the United States, which is the Department of State's responsibility.

Senator JACKSON. That is right and prestige is a very important factor in all of this.

Dr. YORK. Prestige is important. Appearances and realities, both separately and together, are important.

Senator JACKSON. Do you think it would be helpful if more people in the Department of State could be not necessarily trained, but maybe better informed on the long-range direction of our R. & D. efforts affecting vital weapons systems?

Dr. YORK. I think it probably would be better if more people are better informed.

Senator JACKSON. I am not trying to single them out. I am trying to be self-critical. I think this same suggestion might apply to Members of Congress, too, but I was just bringing up this point of trying to see if we can't do a better job in making our foreign policy in a way that will carefully consider various things that could have an impact and a very important impact in our standing among the family of nations.

Dr. YORK. There is no question but what a great deal of what is done in defense in general, and in research and engineering in particular, has an internatioal impact, a world impact.

Senator JACKSON. Not only on our potential foes, but it may have an impact on our allies if they are not properly informed.

Dr. YORK. And on their degree of confidence in us.

Senator JACKSON. Do you have any specific comments as to what might be done in this area to make for better improvement? How would it be, for example, if someone were assigned from the State Department to your department and vice versa?

Dr. YORK. I don't know what good it would do to actually assign someone there.

Senator JACKSON. For periods of time.

Dr. YORK. Except if they were assigned for a period of time in order to familiarize themselves with what was going on, with the idea that they were then going back to State. This could be a useful procedure. If they are simply transferred there could even be some value in that. Having them come over for purposes of becoming familiar for a period might be a useful thing.

Senator JACKSON. This is one area where we certainly could do something more than probably what we have been doing in the past and I say this goes way back, not just to the present situation, but many years back, with science since the advent of the atomic bomb playing such a very vital and important role in diplomacy.

Now, just two other questions: What is your attitude toward a Department of Science?

Dr. YORK. I have heard quite a bit of discussion about it and without forming too concrete an opinion on the total question. There are some subparts to the question, though, that I feel definite about. One is that activities such as those in the Department of Defense, and those of any other department which relate to the mission of that department belong in that department and should be related to the rest of that department's programs. The research and development programs should be considered with the other programs both with regard to objectives and also with regard to allocation of the resources available. The budget problem should go there and be pulled together with other aspects of the department's problem.

In other words, practically all of those things which the Department of Defense is now doing should remain in the Department of Defense whether a Department of Science was formed or not, and I feel certain, without knowing all the details, that one could make the same remarks for the Atomic Energy Commission, for the Department of Agriculture, and for others.

Senator JACKSON. Wouldn't it be pretty hard to pull it all together and put it in one place? Do you think there might be a conflict between departments if you attempted to have one Cabinet office that was in complete charge of science?

Dr. YORK. I think it is important to have science and technology represented at Cabinet level and National Security Council level, but that is a different thing from saying you should make a Department of Science.

When people in the Government talk about science and technology, they are not talking just about basic science, but about development,

engineering, and so on. It is something much broader than just basic science. Actually a large fraction of the support of basic science is now done in a separate agency, namely, the National Science Foundation, and it works very well. But when most Government people talk about science, and I believe that is what people are talking about when they refer to a Department of Science, they are talking about what scientists themselves call something else, namely, technology and development.

If what you mean by a Department of Science is a department which would take everything that is now being done in the field of science out of the agencies where it is now being done and put it into such a department, I think that a Department of Science would have two drawbacks. One drawback, then, is, as I mentioned before, development and applied science, that belongs closely associated with whatever it is being done for. I mean if it is being done for defense purposes it belongs closely associated with the rest of all the defense activities.

The other drawback is that it is probably good in some ways to have a certain amount of diffuse authority. A single authority would be more likely to make very large and significant errors by throwing out whole fields because whoever happened to be in charge at the moment thought they weren't good ideas or worth pursuing.

Senator JACKSON. Dr. York, I am not an advocate of a Department of Science. The proposal reminds me of trying to establish a Department of Economics in the Government. Economics is involved in every department of the Government, but you can't pull it out and put it all in one place. I know you have made a very careful distinction in your comment. It is one thing to talk about putting it all into a Department of Science and Technology and something else to provide support such as the National Science Foundation does, in my judgment, for the improvement of science in all the departments of Government. I believe that is the mission of the Science Foundation, among other things, not just in Government, but throughout our country.

Dr. YORK. Yes; to improve the state of science in the country.

Senator JACKSON. This is right; and we all want to do that, but what has concerned me is, like so much in life, there are people who want to come in with some kind of proposal to set up a committee or department that is going to solve a major problem. It would be like setting up a department to end the cold war. I don't think it is quite that simple and I just wondered whether this really will work. Our previous witnesses have all indicated their opposition to it.

Dr. YORK. On the other hand, having a voice for science and technology, such as a Secretary of such a department would have, is a good thing. Some means can be found other than giving them an operating department with all possible science included in it.

Senator JACKSON. The President's Science Advisory Committee does help in part in advising the President on various things that should be done, I believe.

Dr. YORK. Yes. Dr. Kistiakowsky has an effective voice in the President's Office.

Senator JACKSON. While we are on the subject of the President's Science Advisory Committee, I have always felt that they have done

a good job. They have very carefully maintained it as an advisory organization as distinguished from an operative organization. I wonder what you might think of giving some statutory recognition to the President's Science Advisory Committee so that this concept will be preserved when the new President takes over in January.

Dr. YORK. If I might, I might make a couple of remarks and then return the question back. I do think that it is an important concept and that it is important to continue it. Right now the President's Science Advisory Committee is an excellent committee in terms of its membership and it is a very hard-working committee. Per member, they put in more time, more man-days per year, than any other committee I am familiar with, and they are listened to by the other members of the President's immediate office and their counsel carries weight in decisions made by the President and the President's immediate office.

They have done a good job and the important thing is to make sure that their present stature, to use that word to cover all what I said, be maintained. Now, if making them a statutory committee would contribute toward that, then I am in favor of making them statutory. Right now they do have high stature. A few years ago they didn't. Anything that can be done in insure continuation of the present quality and the present influence of the committee is a good thing in my view. If making it statutory helps on those two points, that's good.

Senator JACKSON. So that as long as those objectives are carried out you do not find objection to it?

Dr. YORK. The reason I just can't answer the question is that my total experience in the Government has been during the period in which the committee has had a high degree of influence without being statutory.

Senator JACKSON. I just want to say if provision is made for statutory recognition of this committee, and it has done a good job, I think it is very important that the President have absolute control to use it as he sees fit in a purely advisory capacity and without any requirement of confirmation of the members by the Senate.

In other words, I think it shouldn't be used as a devise to interfere with his constitutional power to make his own decision, and my only concern is that there might be a danger of this organization that has worked so well falling apart with any change of administration.

Dr. YORK. I would also say that the executive privilege which they now enjoy should be continued too. I believe it adds to their effectiveness and aids them in accomplishing their job.

Senator JACKSON. I would agree with you on that and I think very clearly this is a matter of the Constitution conferring on the President that right, so that anything Congress might do could not affect it. I don't think Congress should attempt to require confirmation of such members.

We have just referred to a very fine Committee, the President's Science Advisory Committee, but I wondered if you had any comments about the committee system as such. We have looked through this long list of committees that are in the Department of Defense.

I am not asking you to comment on committees that are way outside of your area, but I have been a bit concerned about the existence of

some 900 unclassified committees and subcommittees within the Department of Defense alone. Some of them obviously are no longer needed, but they are there.

Dr. YORK. Whether committees are a good or bad thing depends on how they are used rather than being an intrinsic characteristic of the committees as such.

I can't either confirm or deny the 900 figure. I just don't know.

Senator JACKSON. We have a letter here.

Dr. YORK. I can say that in my own office there are quite a few. I guess we make a considerable contribution to that 900.

Senator JACKSON. There are 733 full committees and 179 subcommittees, so that brings it just a little over 900. This does not include the classified committees. This is from the Department of Defense in response to an inquiry that we made on March 11 and signed by O. M. Gale, special assistant, as of April 18.

Dr. YORK. This is committees also by all the different names that are used, like groups, boards, and so forth?

Senator JACKSON. I will tell you some of the names of them. One is the Joint Master Menu Board. One is the Interservice Flight Vehicle Power Group. Another is the Fiscal Sponsors Committee of the Toxicological Information Center. Another is the Department of Army Accelerated Item Reduction Program Task Group. Another one is the Interdepartmental Screw Thread Committee, and then there is the Helium Policy Committee with the following directive in part:

> To study national policies and prevent the loss into the atmosphere of any appreciable part of the country's helium which has not first served the purpose of helium.

I am not trying to be facetious.

Dr. YORK. I will stick by my original statement that a committee or a committee system is not either bad or good on its own, but it depends on how it is used. I am certain that there are obsolete committees. I know that in my own case there are a number of committees recorded as existing which haven't met for a long time. It is simply a matter of making a final decision that they never are going to meet again. But, of course, there are very many kinds. Most of the committees that I deal with are advisory committees of one kind or another through which we seek the judgment and advice of experts in the vast number of fields that we have to deal with.

We have committees in aeronautics, we have committees in electronics, and so forth. In electronics we have quite a few different committees, committees that deal with electronic tubes and parts who advise us as to whether or not the total program in the development of electronic tubes and components is sufficient in all of its aspects. We have advisory committees on radar and so on.

This class of committee is the advisory committee and it is, generally speaking, not in an administrative chain of authority. Questions which are up for decision are not, generally speaking, put through the committee to get their views; but, they deal more with long-range subjects such as whether we are doing enough in certain scientific or technical fields or whether we are putting our attention in the right direction.

On occasion a particular problem comes up that we are going to have to make a decision on at some time in the not-too-distant future

and we may refer to one of these committees for some particular technical advice in that connection. With regard to committees which are advisory to me, they are strictly advisory and not authoritative, and they understand that situation and so do the people in my office.

There are other committees, and some of the ones you named come in this category, which exist simply because there are interdepartmental problems that need to be considered jointly on occasion. All three of the services use aircraft engines. It is necessary to get people together to inform each other as to what is going on and to determine what might be omitted or where duplication might exist. You have two choices. You can get a few knowledgeable people together when a problem comes up and talk about it and then you can all go back to your offices and 6 months later somebody gets some more people together, or you can decide you are going to get the same people together frequently, and if you do, then you call it a committee. That is just the word used for a particular group of people that meet on one problem more than once.

Senator JACKSON. The committee system is an ancient and honorable American custom and I think common to most free society. It has invaded all of our institutions whether it be in the Federal Government or even outside of the area of Government. All organizations use it. I think advisory committees can be very helpful. I am just wondering about the problem where you have an interdepartmental committee, for example, or a departmental committee where the chairman really doesn't have any power to make a decision. I believe Dr. Perkins the other day, and some others, pointed out that so many times when the regular machinery of Government is not able to provide an answer, it is turned over to the committee and then the committee gets it and the problem is that no one has the authority to make a decision within the committee and it will stay there awhile, something will happen to it maybe, and something won't, so I wonder if you made a distinction between the type of committee where a decision can be made, and those where it cannot.

Now, as to advisory committees, I think they are very useful, but that is in a different area. That is not what I am directing my question to.

Dr. YORK. With respect to the committee that I am concerned with, in general the chairman has the authority and the only authority. If votes are taken it is to get a consensus, but in most committees I am familiar with or most committees that I am on there is one person with the authority and the committee is for the purpose of aiding him to come to a conclusion.

Senator JACKSON. I am glad to hear that. I think certainly a committee can accomplish some very useful objectives where there is one person authorized or some devices set up to reach a decision.

Dr. YORK. Two that I am involved with happen to be called councils instead of committees. One of them is the Armed Forces Policy Council. The chairman is the Secretary of Defense and he has the authority and makes the decisions. The other is the Research and Engineering Policy Council, of which I am chairman. It consists of the R. & D. Assistant Secretaries of the services, including the Army's Director of R. & D., the military chiefs of R. & D. of each service, and the Director of ARPA. The existence of that committee does not in

anyway reduce my authority. It is a means I use for finding out what my colleagues in the services think as an aid to coming to decisions that have to be made in defense.

Senator JACKSON. You find it a useful device?

Dr. YORK. Yes.

Senator JACKSON. I will conclude my questioning at this time by just expanding a little bit on this point and ask you this. We all hear from time to time about the amount of redtape within the Military Establishment. I realize this is a generalized complaint that is made not only as far as the Military Establishments is concerned, but within other departments of the Government.

I wonder if you could indicate what your chief obstacles are at the present in trying to get things done, if you have them, and what might be done to improve them. After all, we are trying to be constructive here and certainly welcome any suggestions that you may have to help get your business done with greater dispatch and more efficiency.

Dr. YORK. If I had any really good ideas on how to improve it I would be trying to work them out with the Secretary of Defense or some one like that within the Department.

Senator JACKSON. Where you have the statutory authority.

Dr. YORK. And where he does.

Senator JACKSON. I say to the extent that you have that authority within the Department.

Dr. YORK. Redtape is something that we have plenty of. That is not news. It takes all sort of shapes and forms and each and every instance is something which can be justified in detail. It is only when you look at it in general that you can feel that somehow it doesn't add up. It, of course, causes delays. The problem we started with is one piece of the redtape, the necessity for producing a new budget every 12 months and the necessity for having this reviewed in all of the places that it has to be reviewed within the executive branch and in the legislative branch of the Government.

There are just myriads of rules. I am afraid that I don't know what all of the rules are that my colleagues and I are faced with. I have found it useful, instead of learning what all these problems are myself, to have some other experts on them trying to give me guidance or find loopholes in what we are doing. It takes a long time.

Senator JACKSON. It takes a few Philadelphia lawyers.

Dr. YORK. It takes a long time. When one finally has decided to do something there is a lot of time between when that decision is made and when it is finally carried out. Much of the redtape which involves the many reviews we have relates to laws that have been made to cover one or another kind of special purpose, and relates to the fact that the budget comes in pieces.

The "Military construction" budget is an entirely different budget item from the "Research and development" budget. In the "Military construction" budget, of course, our facilities which are being built for research and development purposes are handled within the executive branch by different people, that is, these two budgets, and within the Congress they are handled by two entirely different sets of committees.

Senator JACKSON. That is right.

Dr. YORK. And just getting these two to mesh is a job. If you have them meshed and then something goes wrong, there is a change in one

of them, then you have to coordinate, in all of the expansive sense of that word, to get the other one to come out right, and there are so many involved in each of these that it is no mean job. I guess that is what you mean by "redtape."

Then there are all of the rules and regulations and questions asked concerning, for example, small business. I have no quarrel with any of the legislation designed to protect small business and don't mean to imply I do, but it is one more thing that people have to take into account.

There are complicated procedures that take a long time which you have to go through, if you happen to need new land for some purpose. These procedures are designed to protect the public against unfair seizure by the Government, but at the same time they are another piece of redtape that we have to be involved with.

We are, of course, concerned with safety procedures at many of our installations where hazardous activities are underway, such as in connection with atomic energy, with launching missiles, or in testing explosives. In order to make sure that safety against accident in these fields is better than safety against ordinary accidents, which happens to be necessary because of the kind of publicity that you can otherwise get, we have all kinds of rules and regulations concerning safety. These come under the general heading of redtape, too, I think.

It is such a broad problem that I don't know how you could decide to get rid of 50 percent or some flat figure like that. What you have to do is make sure that there are in the Government, both in the Congress and in the executive branch, people who are willing to try to either reduce it or at least not keep it from growing any further.

Senator JACKSON. I certainly realize that it is difficult to make specific recommendations for change without having an opportunity to have it thoroughly gone into, even though some of these things are very burdensome. The alternatives make it very difficult.

Senator Muskie.

Senator MUSKIE. I take it we are going to be called.

Senator JACKSON. We are going to have a vote in just a minute on the coal mine safety bill. We will have a 15-minute recess and then I am sure it won't be too long after that. We will be right back. I hope we won't tie you up too long.

(A brief recess was taken.)

Senator JACKSON. The committee will resume. I am sorry, Dr. York, that we were detained.

Mr. Pendleton, do you have some questions?

Mr. PENDLETON. Thank you.

Dr. York, you referred earlier to a Council called the Research and Engineering Defense Council.

Dr. YORK. Research and Engineering Policy Council.

Mr. PENDLETON. Could you describe briefly the nature and operations of that Council?

Dr. YORK. The nature of the Council is best given by describing its membership. It consists of the Assistant Secretaries for Research and Development for each of the services; in the case of the Army that means the Director of Research and Development. It also includes the military chiefs of each service, including the Marines, the Director of ARPA, my two deputies and myself.

It meets about once a month and its purpose is to discuss overall research and engineering problems, particularly in this case from an administrative point of view. It tries to come up with proposals or solutions as to how to handle some of these problems better.

Mr. PENDLETON. Do you think that this Council has been effective in coordinating research and development within the services?

Dr. YORK. Yes; although not so much by its own deliberations but by suggestions emanating from the Council on how to do it at levels where more detail can be handled.

Mr. PENDLETON. Now, turning next to the Department of State, what is the present procedure whereby the Department of Defense keeps the Department of State informed of developments in the research and development field?

Dr. YORK. The primary contact between the Department of Defense and the Department of State in all fields is through the Assistant Secretary of Defense for International Security Affairs. That is other than at the level of the Secretaries and through the National Security Council. In my office I have an Office of Foreign Programs and one of the functions of that office is to work with the Assistant Secretary of Defense, ISA, in things which involve State.

As far as I am concerned that usually has to do, though, with things like problems concerning programs which we conduct in foreign countries, and how we should conduct them, and so on, rather than with larger scale questions concerning the influence of research and development on the U.S. foreign policy. These questions are generally handled by the Assistant Secretary of Defense for ISA and the Secretary himself in connection with the Security Council and other groups of that sort.

Mr. PENDLETON. Through those people that you have mentioned, information on your research and development progress does get to the Secretary of State?

Dr. YORK. Yes; through those channels or through the National Security Council and the Cabinet.

Mr. PENDLETON. I have no further questions.

Senator JACKSON. I understand you have a 4 o'clock appointment, Dr. York. I think you can almost make it. It is not more than 15 minutes away.

We want to thank you for your appearance here today and we appreciate having your comments on the various questions put to you.

The committee will stand adjourned subject to the call of the Chair. We contemplate our next set of hearings the week after next. We have not the final dates on that but it will relate to people and we may be calling you again, Dr. York. If so, we will give you ample notice.

Dr. YORK. Thank you, sir.

(Whereupon, at 3:45 p.m., Wednesday, April 27, 1960, the committee adjourned subject to the call of the Chair.)

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